NOV 1977

practical WIRELESS

45p

83

EXTRA INSIDE

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WIDE-RANGE VOLTMETER

F
ESONANCE
NDICATOR

&

IC OF THE MONTH (ZN1304E TIMER)

ALL-BAND SW CONVERTER

T.T.L. 74 I.C's By TEXAS, NATIONAL, I.T.T., FAIRCHILD Etc

7400	14p	7413	30p	7432	25p	7454	15p	7490	35p	74121	25p	74139	100p	74156	70p	74174	100p	74189	350p
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7402	14p	7416	30p	7438	25p	7470	30p	7492	45p	74123	60p	74142	270p	74160	90p	74176	100p	74191	140p
7403	14p	7417	30p	7440	15p	7472	25p	7493	40p	74125	50p	74143	270p	74161	90p	74177	100p	74192	120p
7404	14p	7420	15p	7441	65p	7473	30p	7495	60p	74126	50p	74144	270p	74162	90p	74178	140p	74193	120p
7405	14p	7422	20p	7442	65p	7474	30p	7496	70p	74130	130p	74145	75p	74163	90p	74179	140p	74194	100p
7406	40p	7423	25p	7445	80p	7475	30p	74100	95p	74131	100p	74147	230p	74164	125p	74180	100p	74195	100p
7407	40p	7425	25p	7446	85p	7476	30p	74104	40p	74132	65p	74148	160p	74165	125p	74181	200p	74196	100p
7408	20p	7426	25p	7447	75p	7483	85p	74105	40p	74135	100p	74150	120p	74166	125p	74182	75p	74197	100p
7409	20p	7427	25p	7448	70p	7485	100p	74107	30p	74136	80p	74151	65p	74167	325p	74184	150p	74198	185p
7410	15p	7428	40p	7450	15p	7486	30p	74109	50p	74137	100p	74153	65p	74170	200p	74185	150p	74199	185p
7411	20p	7430	15p	7451	15p	7489	250p	74118	90p	74138	125p	74154	120p	74173	150p	74188	350p		
7412	20p			7453	15p			74120	90p			74155	70p						

SEMICONDUCTORS
by MULLARD, TEXAS, MOTOROLA, SIEMENS, I.T.T., R.C.A.

AA113	10p	BA138	16p	BC168B	14p	BC548C	14p	BF123	45p	BF336	35p	BY164	50p	OC140	150p	TIP35A	230p	2N1305	30p
AA144	10p	BA148	16p	BC168C	15p	BC549B	13p	BF125	45p	BF337	35p	BYX94	8p	OC171	40p	TIP35C	280p	2N1306	38p
AAZ17	30p	BA154	12p	BC169C	15p	BC549C	14p	BF127	50p	BF363	60p	C1120	30p	OC200	80p	TIP36A	350p	2N1308	50p
AC121	30p	BA157	15p	BC171	12p	BC557	13p	BF166	30p	BFS94	30p	C1164	20p	ORP12	70p	TIP41A	70p	2N1711	22p
AC126	19p	BA173	15p	BC172C	12p	BCY34	80p	BF167	25p	BFW58	20p	E100	42p	R1039	150p	TIP41B	75p	2N2219A	25p
AC127	19p	BA216	16p	BC178A	16p	BCY70	15p	BF173	25p	BFX29	30p	E300	47p	TIP29	45p	TIP41C	80p	2N2483	30p
AC127/01	25p	BA316	16p	BC182	10p	BCY71	20p	BF179	35p	BFX81	130p	E430	125p	TIP29A	47p	TIP42A	80p	2N2906	18p
AC128	18p	BAX13	5p	BC182L	12p	BCY72	15p	BF179C	40p	BFX84	25p	MJE340	45p	TIP29C	75p	TIP42B	85p	2N2907	20p
AC151	25p	BAX16	5p	BC183	10p	BD121	85p	BF180	30p	BFX85	30p	MPSA06	25p	TIP30	55p	TIP2955	70p	2N3053	20p
AC153K	40p	BB105A	35p	BC183L	12p	BD123	100p	BF181	35p	BFX87	25p	OA10	40p	TIP30A	58p	TIP3055	55p	2N3054	50p
AC176	20p	BB110	45p	BC184	10p	BD124	85p	BF182	30p	BFX88	25p	OA47	15p	TIP30B	65p	TIS90	25p	2N3055	60p
ACY17	35p	BC107	10p	BC184L	12p	BD131	36p	BF183	30p	BFY50	20p	OA90	6p	TIP30C	80p	TIS91	25p	2N3439	50p
ACY21	30p	BC108	10p	BC186	24p	BD132	39p	BF186	25p	BFY51	20p	OA91	6p	TIP31	55p	IN914	5p	2N3702	11p
AD149	60p	BC108C	15p	BC205	14p	BD133	45p	BF194	10p	BFY52	20p	OA202	8p	TIP31A	58p	IN3754	10p	2N3703	12p
AD161	40p	BC109	10p	BC212	11p	BD135	40p	BF195	10p	BFY90	125p	OC23	200p	TIP31B	65p	IN4001	5p	2N3704	11p
AD162	40p	BC109C	14p	BC212L	*12p	BD136	40p	BF196	10p	BR101	35p	OC25	100p	TIP31C	70p	IN4002	5p	2N3705	12p
AD161/2MP	90p	BC113	12p	BC213L	12p	BD137	40p	BF197	10p	BRY39	35p	OC28	75p	TIP32	60p	IN4003	5p	2N3706	11p
AF114	22p	BC117	19p	BC214	13p	BD139	38p	BF198	25p	BRY56	35p	OC35	75p	TIP32A	65p	IN4004	5p	2N3711	12p
AF115	22p	BC125	20p	BC214L	14p	BD140	40p	BF199	25p	BSX20	20p	OC42	35p	TIP32B	85p	IN4005	5p	2N3715	300p
AF116	22p	BC126	15p	BC258	13p	BD181	80p	BF200	30p	BSY40	25p	OC43	35p	TIP32C	90p	IN4006	6p	2N3772	175p
AF117	22p	BC146	12p	BC294	35p	BD182	80p	BF224	20p	BSY95	20p	OC45	35p	TIP33	100p	IN4007	7p	2N3819	25p
AF118	50p	BC147	10p	BC303	55p	BD207	70p	BF225	20p	BT100A	80p	OC71	25p	TIP33A	105p	IN4148	4p	2N3866	95p
AF125	25p	BC148	10p	BC317	15p	BD233	50p	BF241	16p	BU105	150p	OC72	30p	TIP33B	115p	IS44	4p	2N3904	15p
AF139	35p	BC148C	14p	BC323	60p	BD263	65p	BF244B	35p	BU133	75p	OC75	30p	TIP33C	130p	2N456A	90p	2N4062	14p
AF239	45p	BC149	10p	BC328	13p	BDY10	100p	BF257	26p	BU208	220p	OC81	30p	TIP34	115p	2N697	15p	2N4126	20p
ASY26	40p	BC157	10p	BC338	12p	BDY62/01	90p	BF258	26p	BY100	20p	OC81D	25p	TIP34A	118p	2N929	20p	2N5061	35p
BA114	9p	BC158	10p	BC547	12p	BF120	50p	BF259	30p	BY126	15p	OC83	50p	TIP34B	145p	2N930	20p	2N5163	35p
BA121	9p	BC159	10p	BC547B	13p	BF121	45p	BF274	15p	BY127	19p	OC84	50p	TIP35	225p	2N1302	25p	2N6027	50p
		BC167A	12p	BC548	12p			BF324	30p	BY133	22p							2SD234	50p

BZY88
400M.W.
Zeners

OV7	10p
2V4	10p
2V7	10p
3V0	10p
3V3	10p
3V6	10p
3V9	10p
4V7	10p
5V1	10p
5V6	10p
6V2	10p
6V8	10p
7V5	10p
8V2	10p
9V1	10p
10V	10p
11V	10p

BZY88

12V	10p
13V	10p
15V	10p
18V	10p
20V	10p
22V	10p
27V	10p
30V	10p
33V	10p
100 Mixed Zeners	850p
BZY88 Zeners	850p

SN76013ND	125p
SN76013N	180p
SN76023ND	125p
SN76023N	180p
SN76227N	160p
SN76228N	180p
SN76666N	100p
ZN414	120p

CA3090AQ	400p

TAA300	150p
TAA350	190p
TAA550	50p
TAA570	220p
TAA661B	140p
TAA700	390p
TAD100	250p
TAD110	200p
TBA120S	125p
TBA120T	125p
TBA540	300p
TBA540Q	400p
TBA550Q	400p
TBA560	400p
TBA641A12	250p
TBA720	230p
TBA800	100p
TBA820	100p
TBA990	250p
TCA270Q	250p
TCA270S	250p

LM301A	65p
LM307N	65p
LM308TO5	130p
LM308 8 DIL	130p
LM309K	180p
LM317K	325p
LM348N	200p
LM380N	110p
LM555	35p
LM710 TO5	60p
LM710 P	65p
LM723 TO5	60p
LM723 14 DIL	75p
LM741	25p
LM748	45p
LM1303N	155p
LM3900	90p

NE555	35p
NE556	100p
NE562B	400p

ELECTROLYTIC CAPACITORS

µF/V	
·47/25	5p
1/16	5p
1/25	5p
1/50	5p
2·2/25	5p
2·2/35	5p
3·3/25	5p
4·7/10	5p
4·7/16	5p
4·7/25	5p
4·7/50	5p
6·8/25	5p
10/10	5p
10/16	5p
10/25	5p
10/35	5p
10/50	5p
22/6V3	5p
22/10	5p
22/16	5p
22/25	5p
22/35	5p
22/50	6p
33/6V3	5p
33/16	6p
33/25	6p
33/40	6p
33/50	7p
47/10	6p
47/16	6p
47/25	6p
47/35	6p
47/50	7p
100/10	6p
100/16	6p
100/25	6p
100/50	8p
100/63	10p
125/15	6p
220/16	10p
220/25	12p
220/50	20p
330/25	15p

330/35	16p
330/50	18p
470/10	12p
470/25	16p
470/35	18p
470/50	22p
680/25	25p
1000/16	25p
1000/35	30p
1000/63	50p
2200/10	28p
2000/35	50p
2200/16	35p
2200/63	75p
2200/100	120p
3300/16	40p
3300/25	42p
3300/63	80p
4700/25	45p
4700/40	50p
4700/63	120p

POLY'TER CAP'ITORS
Mullard or Erie

µ/F	
·001	5p
·0022	5p
·0033	5p
·0047	5p
·0068	5p
·01	5p
·022	5p
·033	5p
·047	5p
·1	6p
·22	7p
·33	9p
·47	12p
1·00	20p
2·2	25p
4·7	35p
6·8	40p

SPECIAL OFFERS

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BC148
BC149
BC157
BC158
BC159
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BF195
BF196
BF197
100 ASSORTED FOR £7·50p

IN4148
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741 Op AMPS
100 for **£20**

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100 for **£30**

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24V 3 C.O. H.D. 11 Pin Plug 1N **£1·00** Each

ASSORTED POLYESTER CAPACITORS
100 for **£3·00**

BYX94 DIODES
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100 for **£6·00**

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4500/64V C.432 Screw Terminal **75p**

RESISTORS CARBON FILM 5%

·25 W 2·2Ω–4·7M	2p
·5 W 2·2Ω–4·7M	2·5p
1 W 2·2Ω 10 MEG	3·5p

POTENTIOMETERS

1K Lin	30p
5K Lin	30p
10K Lin	30p
25K Lin	30p
50K Lin	30p
100K Lin	30p
250K Lin	30p
500K Lin	30p
1 Meg Lin	30p
2 Meg Lin	30p
5K Log	30p
10K Log	30p
25K Log	30p
50K Log	30p
100K Log	30p
250K Log	30p
500K Log	30p
1 Meg Log	30p
2 Meg Log	30p

ROTARY SWITCHES BY LORLIN

1P 12W	40p
2P 6W	40p
3P 4W	40p
4P 3W	40p

MULLARD POT CORES

LA3	100–500 KHz	75p
LA4	10–30 KHz	100p
LA5	30–100KHz	100p
LA7	< 10KHz	100p

LA13 FOR W.W. OSCILLOSCOPE **200p**

SPECIAL SCOOP OFFERS

LEDS ·125
OR ·2 RED ONLY
100 for £9·00
1000 for £60·00
SPECIAL QUOTATION FOR LARGER QUANTITIES

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300 Volts 16 Amp **250p**

CMOS

4000	20p	4023	20p	4055	140p
4001	20p	4024	100p	4056	145p
4002	20p	4025	20p	4060	130p
4006	120p	4026	200p	4066	55p
4007	20p	4027	85p	4069	30p
4009	70p	4028	155p	4071	30p
4011	20p	4029	130p	4072	30p
4012	20p	4030	60p	4081	20p
4013	55p	4032	150p	4082	30p
4015	90p	4043	220p	4510	145p
4016	55p	4046	150p	4511	200p
4017	110p	4047	115p	4516	140p
4018	250p	4049	70p	4518	110p
4020	140p	4050	50p	4528	130p
4022	180p	4054	130p		

BRIDGE RECTIFIERS

		V/REG.	
1A 50V	25p	7805	140p
1A 100V	30p	7812	140p
1A 200V	30p	7815	140p
1A 400V	35p	7818	140p
1A 600V	40p	7824	150p
2A 50V	35p		
2A 100V	50p		
2A 200V	55p		

SKELETON PRE-SET POTENTIOMETERS

0·1W 50N–5M mini vert & horiz	7p
·25W 100N–3·3M horiz.	7p
·25W 200N–4·7M vert.	8p

TANTALUM BEAD CAPACITORS
35V: 0·1µF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2, 3·3, 4·7, 6·8,25V 1·5, 10, 16V 4·7, 10, 22, 10V 4·7, 15, 25, 33
Price **14p** each

LEDS

RED ·125	15p
GREEN ·125	25p
YELLOW ·125	25p
RED ·2	15p
GREEN ·2	25p
YELLOW ·2	25p
DL747 Display	200p

DIL SOCKETS

8 Pin	13p
14 Pin	14p
16 Pin	15p

BZX61
Zeners
1·3W

6V8	15p
9V1	15p
11V	15p
13V	15p
15V	15p
22V	15p
30V	15p
39V	15p
43V	15p
47V	15p
51V	15p
56V	15p
68V	15p
72V	15p
160V	15p

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ISSUE 848

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News and Views

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MW Broadcast Bands .... *Charles Molloy G8BUS*
VHF Bands .... *Ron Ham BRS15744*

For our Constructors

486 **A WIDE RANGE VOLTMETER for AC, DC and RF**
An input impedance of 11MΩ enables this voltmeter to be used on just about any circuit without upsetting the circuit conditions. Six ranges to 1000V plus probes permits measurement of AC or DC voltages *M. Tooley BA, G8CKT*

490 **ALL BAND SHORT WAVE CONVERTER—1**
This converter can be aligned for the amateur bands or the SW broadcast bands and provides an IF output at 5·5MHz for feeding into your main receiver .... *F. Rayer G3OGR*

497 **RF RESONANCE INDICATOR**
With the aid of an external signal source this very useful indicator can be used to find the resonant frequency of a tuned circuit or to select values of inductance and capacitance for a given frequency *D. H. E. King G3TQN*

505 **THE PW 'JUBILEE' ELECTRONIC ORGAN—3**
Details this month on the operation and adjustment of the melody, drum and rhythm, and accompaniment sections .... *M. J. Hughes MA, C.Eng, MIERE*

512 **DESIGN YOUR OWN PROJECTS—3**
This **Car Courtesy Light** project will give you another 15 seconds of light inside your car when the door clicks to, instead of plunging you into darkness in the usual way! .... *Toby Bailey and Bob Whitaker*

General Interest

501 **SO YOU WANT TO PASS THE R.A.E?—3**
Ohm's Law is translated into some practical transistor circuits and the very important principles of magnetism are discussed in this part .... *John Thornton Lawrence GW3JGA and Ken McCoy GW8CMY*

516 **IC OF THE MONTH**
The ZN1304E is used in timing circuits to provide accurate delays of up to one year! Several circuits are shown for different applications of the IC.

★ Free This Month!

24 PAGE 'COMPONENT SOURCE DIRECTORY'

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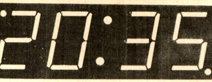
TIME FOR WIRELESS?



The MA1012 LED digital clock module is a full 12/24 hour format clock unit, operating from 50/60Hz mains and offering a host of features: Hours, minutes display in bright 0.5" LEDs, with optional seconds, sleep and snooze alarms, fast and slow setting, PM indicator, switched output for radio, but the most important feature is the non-multiplexed directly driven display. This means no RFI, so the MA1012 is ideal for use in any type of radio/tuner etc. The neat fitting means it can be slotted into many existing cabinets/chassis - only 1.75 x 3.75 x 0.7 " total!! £9.45 per module - isolating mains transformer £1.50 (8% vat) Two modules and two transformers for £20.00 + 8% VAT.

AMBIT announce a new addition to the catalogue - information on TOKO's new ceramic ladder filters, 2.4kHz SSB filters etc. HF coils, new flat faced low cost panel meters. Catalogue 45p.

DETECKNOWLEDGEY

Metal locator principles and practise, including some of the facts that the manufacturers of £100+ metal locators wouldn't like you to know !! £1.00 The Bionic Ferret 4000 – A little detector technology of our own. The VCO based metal locator for the electronics constructor, including platsic moldings for housings of electronics and search coil, tubing etc. Can be set up using just a test meter. 'All in' price £34.26 inc PP and 8% VAT.

DEMONSTRATIONS AVAILABLE AT OUR OFFICES IN BRENTWOOD HIGH ST.

COMPONENTS ETC:

As usual, Ambit offers a comprehensive range of components and modules for wireless, including over 300,000 types of signal inductors for just about every conceivable RF signal application from 5kHz to 300MHz.

SEMICONDUCTORS

CA3089E	FM IF	1.94
KB4402	FMIF	1.94
HA1137W	FM IF	2.20
TBA120	FM IF	0.75
TBA120S	FM IF	1.00
SN76660N	FM IF	0.75
uA720	AM radio	1.40
CA3123E	AM radio	1.40
HA1197	AM radio	1.40
TBA651	AM radio	1.40
MC1350	agc gain	1.00
uA753	FM gain	1.80
LM1496	Bal mix	1.25
MC1310P	mpx dec.	2.20
CA3090AQ	mpx dec.	4.35
HA1196	mpx dec.	4.20
LM380N	2w AF	1.00
LM381	st. pream.	1.81
tda2020	15w AF	2.99
tca940e	10w AF	1.80
tba810as	7w AF	1.08
LM301an	op amp	0.39*
CA3130T	mos oa	0.85*
uA741	op amp	0.34*
LM3900	op amps	0.68*
7805uc	5v/1A	1.55*
tda1412	12v/.6A	0.95*
78M20uc	20v/.5A	1.20*
78M24uc	24v/.5A	1.20*
uA723cn	variable	0.80*
NE550a	variable	0.80*
TAA550b	32v ref.	0.50*
icl8038cc	sig gen	4.50*
NE555v	timer	0.70*
NE566v	vco	2.50*
NE567v	tone dec.	2.50*
NE560B	hf pll	3.50*
NE561B	hf pll	3.50*
NE565k	lf pll	2.50*
MC1312	quad	1.50
11C90	650MHz	14.00*
ZTX107	50v/.3W	0.14
ZTX108	30v/.3W	0.14
ZTX109	30v/.3W	0.14
BC413	lo noise	0.18
40238	shld.RF	0.25*
BF224	.6GHz RF	0.22
BF274	.7GHz	0.18
ZTX212	50v/.3W	0.17
ZTX213	30v/.3W	0.16
ZTX214	30v/.3W	0.17
ZTX451	60v/1W	0.18
ZTX551	60v/1W	0.18
BD515	45v/10W	0.27
BD516	45v/10W	0.30
BD535	60v/50W	0.52
BD536	60v/50W	0.53
BD609	80v/90W	0.70
BD610	80v/90W	1.20
BF256	1GHz jfet	0.34
E176	p ch. swt.	0.38
MEM614	(40822)	0.38*
MEM616	(40673)	0.57*
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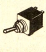

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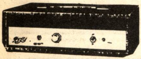

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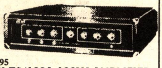

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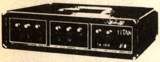

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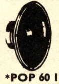

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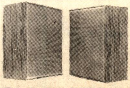

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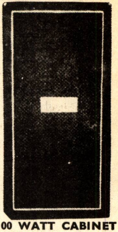

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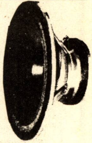

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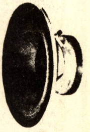

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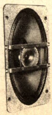

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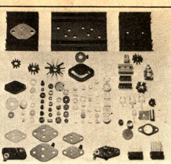

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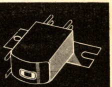

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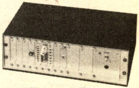

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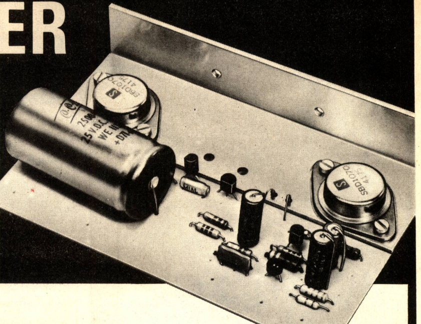

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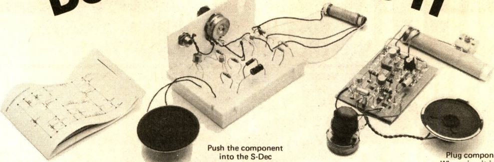
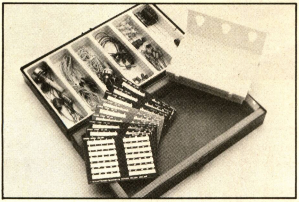
DeC·IT and BLOB·IT



Each circuit diagram has the holes numbered into which the components are inserted.

Push the component into the S-Dec No soldering.

Plug components in and out. When circuit is proved working, transfer component by component to exactly same numbered position in Blob-Board.



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NB The discrete components to build the above S-De-K-IT are listed but not supplied. This is because using discrete or surplus components you can buy all the components very cheaply from your local component supplier.

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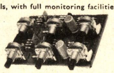

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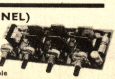

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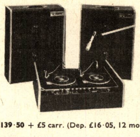

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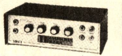

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7476	37p
7480	54p
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7493	40p
7494	90p
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7496	90p
7497	290p
74100	140p
74104	75p
74105	75p
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74121	32p
74122	52p
74123	75p
74125	70p
74126	65p
74128	82p
74132	81p
74136	81p
74141	85p
74142	300p
74145	95p
74147	205p
74148	160p
74150	130p
74151	81p
74153	81p
74154	160p
74155	97p
74156	97p
74157	97p
74159	250p
74160	130p
74161	130p
74162	130p
74163	130p
74164	140p
74165	150p
74166	160p
74167	320p
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74173	190p
74174	130p
74175	97p
74176	130p
74177	130p
74180	120p
74181	324p
74182	150p
74184	250p
74185	190p
74186	990p
74190	160p
74191	160p
74192	130p
74193	130p
74194	160p
74195	110p
74196	130p
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4030	67p
4040	150p
4042	97p
4043	100p
4046	150p
4047	120p
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AC128	25p
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AC187	25p
AC188	25p
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AF115	30p
AF116	30p
AF117	30p
AF127	40p
AF139	40p
AF239	48p
BC107/B	10p
BC108/B	10p
BC109	10p
BC109C	11p
BC147	9p
BC148	8p
BC149	10p
BC157	11p
BC158	13p
BC159	13p
BC169C	15p
BC171	12p
BC172	11p
BC177	20p
BC178	17p
BC179	20p
BC182	12p
BC183	12p
BC184	14p
BC187	32p
BC212	14p
BC213	12p
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TIP41C	84p
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2N1304	75p
2N1305	75p
2N1306	75p
2N1307	75p
2N1613	22p
2N1711	22p
2N1893	32p
2N2102	60p
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2N2904/A	22p
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2N2907A	25p
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2N3053	22p
2N3054	65p
2N3055	65p
2N3439	72p
2N3442	151p
2N3565	34p
2N3643	48p
2N3644	48p
2N3702	14p
2N3703	14p
2N3704	14p
2N3705	14p
2N3706	14p
2N3708	14p
2N3709	14p
2N3707	14p
2N3711	14p
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ZN4125/6	22p
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2N4427	97p
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2N5179	75p
2N5245	40p
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2N5401	62p
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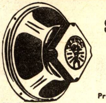

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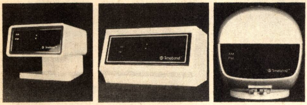

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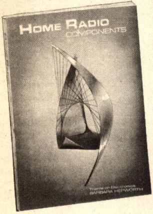

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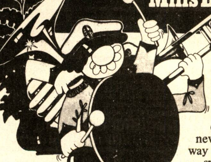

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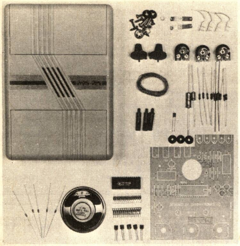

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N.B. The CHROMA-CHIME is also available, fully assembled, price £24·95 inc VAT and post and packing.

Please allow 7-21 days for delivery.

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*These tunes play longer if the push button is kept pressed.

- Handsome purpose built ABS cabinet
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with two independent secondary windings

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MINIATURE MAINS Primary 240V

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2022	9V–0–9V 100mA	90p*
2023	12V–0–12V 100mA	95p*

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No.	Secondary	Price	
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2028	12V–0–12V 1 amp	£2·60*	P. & P. 30p
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STANDARD MAINS Primary 240V
Multi-tapped secondary mains transformers available in ½ amp, 1 amp and 2 amp current rating. Secondary taps are 0–19–25–33–40–50V.

Voltages available by use of taps:
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No.	Rating	Price	
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2032	1 amp	£4·40*	P. & P. 50p
2033	2 amp	£5·45*	P. & P. 85p

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S131	5 pin DIN plug to 3 pin DIN plug 1 & 4 and 3 & 5 length 1·5m	83p*
S132	2 pin DIN plug to 2 pin DIN socket length 10m	98p*
S133	5 pin DIN plug to 2 phone plugs connected to pins 3 & 5 length 1·5m	75p*
S134	5 pin DIN plug to 2 phono sockets connected to pins 3 & 5 length 23cm	68p*
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BA BOLTS—packs of BA threaded cadmium-plated screws, slotted cheese head.

Supplied in multiples of 100

Type	No.	Price	Type	No.	Price
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1in 2BA	842	£0·69	¼in 4BA	847	£0·33
½in 2BA	843	£0·54	1in 6BA	848	£0·50
¼in 2BA	844	£0·63	½in 6BA	849	£0·30
¼in 6BA	850	£0·33			

BA NUTS—packs of cadmium-plated full nuts in multiples of 100

Type	No.	Price	Type	No.	Price
0BA	855	£0·90	4BA	857	£0·42
2BA	856	£0·60	6BA	858	£0·36

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Type	No.	Price	Type	No.	Price
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2BA	860	£0·15	6BA	862	£0·12

SOLDER TAGS—hot tinned supplied in multiples of 100

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2BA	852	£0·36	6BA	854	£0·30

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INSTRUMENT CASES. In two sections vinyl covered top and sides, aluminium bottom, front and back.

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157	6in	4¾in	1¾in	£1·25*
158	6in	5¼in	2½in	£1·60*

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160	4in	4in	1½in	62p*
161	4in	2¼in	1½in	62p*
162	5¼in	4in	1½in	74p*
163	4in	2¼in	2in	64p*
164	3in	2in	1in	44p*
165	7in	5in	2½in	£1·04*
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200V RMS	BR1/200	£0·32
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QUICK BLOW 20mm

Type	No.	Type	No.	Type	No.
150mA	611	1A	615	3A	619
250mA	612	1·5A	616	4A	620
550mA	613	2A	617	5A	621
800mA	614	2·5A	618		

All 5p each

ANTI-SURGE 20mm

Type	No.	Type	No.	Type	No.
100mA	622	1A	625	2·5A	628
250mA	623	2A	626	3·15A	629
500mA	624	1·6A	627	5A	630

All 7p each

QUICK BLOW 1¼in

Type	No.	Type	No.	Type	No.
250mA	631	500mA	632	800mA	634

All 7p each

Type	No.	Type	No.	Type	No.
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1·6A	636	3A	639	5A	642
2A	637				

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A range of rocker switches SPST—moulded in high insulation. Material available in a choice of colours, ideal for small apparatus

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Description	No.	Price
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Miniature SPST toggle, 2 amp 250V a.c.	1959	£0·55*
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Miniature DPDT toggle, centre off, 2 amp 250V a.c.	1961	£0·85*
Push button SPST, 2 amp 250V a.c.	1962	£0·65*
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400	THY1A/400	£0·38
600	THY1A/600	£0·45
800	THY1A/800	£0·58

3 AMP TO66 CASE

Volts	No.	Price
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100	THY3A/100	£0·30
200	THY3A/200	£0·33
400	THY3A/400	£0·42
600	THY3A/600	£0·50
800	THY3A/800	£0·65

5 AMP TO66 CASE

Volts	No.	Price
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100	THY5A/100	£0·46
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400	THY5A/400	£0·57
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Volts	No.	Price
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Volts	No.	Price
50	THY10A/50	£0·51
100	THY10A/100	£0·57
200	THY10A/200	£0·62
400	THY10A/400	£0·71
600	THY10A/600	£0·99
800	THY10A/800	£1·22

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Volts	No.	Price
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100	THY16A/100	£0·58
200	THY16A/200	£0·62
400	THY16A/400	£0·77
600	THY16A/600	£0·90
800	THY16A/800	£1·38

30 AMP TO94 CASE

Volts	No.	Price
50	THY30A/50	£1·18
100	THY30A/100	£1·43
200	THY30A/200	£1·63
400	THY30A/400	£1·79
600	THY30A/600	£3·50

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BT102/500R	£0·80
BT106	£1·25
BT107	£0·93
BT108	£0·98
2N3228	£0·70
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MC4	21	miniature ceramic capacitors, 3 or each value—4,700pF, 6,800pF, 0·01μF, 0·015μF, 0·022μF, 0·033μF and 0·047μF	16163	*£0·60

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BACK NUMBERS

We are very glad to announce the re-establishment of a PW Back Numbers Service for our readers. In future back numbers dated from June 1977 only will be available from our Post Sales Department for 65p, which includes postage and packing. Cheques and Postal Orders should be made payable to IPC Magazines Ltd.

Send your orders to:- Post Sales Department, IPC Magazines Ltd., Lavington House, Lavington Street, London SE1 0PF.

Perseverance

AWAY from any technicalities this month. Just the story of a PW reader's perseverance. Charlie M. is nearly 78. He was a Marconi marine operator in World War 1 and in his latter years has long cherished the idea of joining the radio amateur fraternity and talking to other folk around the world. He'd done all the swotting but a couple of problems confronted him. His wife is a chronic invalid requiring constant attention, and they live in a remote part of Wales, with but one equally lonely neighbour. How could he leave his wife and go anywhere to take the RAE and the code test?

Following up a couple of suggestions Charlie was able to get the nearest technical college, some 20 miles away, to make the necessary arrangements for him to sit the exam last May. His sole neighbour came round for a few hours and off went Charlie to college, the only candidate! The result? A "distinction" in Part 1 of the paper and a "credit" in Part 2. So far, so good, but taking the code test wasn't quite so simple!

A trip to the nearest testing centre would have meant too long away from home and his wife. He contacted the centre, at Cardiff, and eventually the Marine Radio Surveyor there telephoned Charlie to say that he would call round the next time he was in the area on duty. Eventually he turned up and "they did the necessary test on the kitchen table" A few days later a "pass" certificate arrived. Charlie writes "prompt and willing service like this, in these days of 'couldn't care less' is really most heart-warming".

A lovely story, isn't it? A GW4 call ought to be on its way very soon. Another not-so-young amateur has loaned Charlie an AR88 receiver plus a 50 watt transmitter so at long last a dream is about to be fulfilled. Charlie has been reading PW since 1952, "a valuable wireless encyclopaedia that I wouldn't part with for all the tea in China". With the present price of tea, that values PW very highly indeed!

Due to increased production costs, the cover price of your copy of *Practical Wireless* has been increased to 45p. The price for new binders has also been increased, as from the 1st October to £2·85. These price increases have been approved by the Price Commission.

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All queries must be accompanied by a stamped self-addressed envelope otherwise a reply cannot be guaranteed.

NEWS... NEWS... NEWS...

A Century of Recorded Sound

As previewed in the September issue of PW, the City of London Phonograph and Gramophone Society recently held an exhibition of early reproducers and associated items at the British Institute of Recorded Sound, Exhibition Rd., Kensington, which celebrated one hundred years of recorded sound.

1877 was in fact a year of universal significance for the sound recording industry, seeing the parallel but independent emergence of two versions of a world-shattering device—the sound reproducer, or "talking machine". Charles Cros in France and Thomas Edison in the United States had almost simultaneously arrived at the same answer to an interesting problem, and while Edison's was a practical working model, the Cros version although restricted to a set of detailed plans, was every bit as brilliantly conceived. It was largely lack of funds and his failure to convince a prospective backer which prevented Cros from seeing his machine emerge as a reality.

Edison v Cros

The exhibition itself naturally displayed an emphasis upon Edison's machines, although Cros was in a sense acknowledged by the inclusion of an Emile Berliner hand-cranked gramophone; it was Berliner who had eventually developed the reality from the plans Cros had deposited at the Academie Francaise in April 1877.

Whatever the arguments about origins, however, a stroll around this display evoked an atmosphere of warm, pre-electric nostalgia. Delicate cylinder phonographs rubbed shoulders with bluff, aristocratic console gramophones in select veneers. Splendid wooden horns balanced at the end of strange foil contraptions with worm gear drives and irresistible cranking handles peered out at an utterly changed world.

Surprisingly, in spite of their great age, most of the machines on view were still playable, in fact, at the height of its popularity, the gramophone was capable of very good reproduction, even though little scientific investigation of basic principles had accompanied its development. The HMV "Re-entrant" model (console gramophone of about 1930) proved very pleasant to listen to in spite of a relatively narrow audio range.

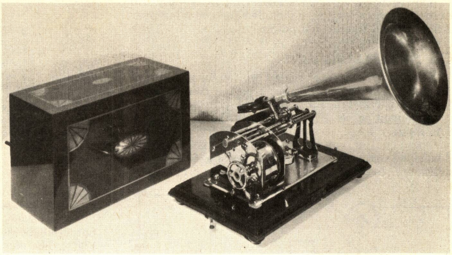
Perhaps a good deal of the interest evident at the exhibition may be dismissed as pure sentimentality, for the machines are somewhat crude by modern standards, but they do represent the beginnings of an immense extension of the range of human experience, and as such they will remain vital informational pieces of equipment. They are additionally interesting as a group of acoustic dinosaurs—they represent the visible and audible end of an era, their electrical counterparts proving unequally effective and competitive in the ensuing conflict.

On the other hand, they had, and still retain, real beauty; a combination of satisfying mechanical symmetry and the atavistic flesh-and-blood appeal of real wood, the voices of Melba and Caruso, and above all, an aura of magic and mystery which characterised an age of real discovery.

Past successes

In terms of the eventual establishment of enterprise in the reproducer field, there was plenty of evidence of the developing "names" in audio devices. Thorens, for example, now heavily committed to quality hi-fi, were represented by an early piece of acoustic precision engineering in the shape of a particularly attractive motor design for a phonograph.

The chronological span of the exhibition was not restricted to the purely acoustic devices, and a selection of early "radio-gramophones" and electrically operated record players was in evidence, including the well-known Decca "Deccalian" with interchangeable heads for 78 or LP. Long-playing records were the "coming thing" in the fifties, and also included in the display was a range of earlier attempts to produce longer playing times, among which was a variable-speed type, designed to exploit the higher speeds at the perimeter of the disc, although this had the disadvantage that a complex device was needed for replay—one which produced a differential slowing towards the centre. Edison's attempts were more practical and saleable—a long player at 78rpm, which clearly necessitated a remarkably close-cut groove, a good deal closer than a modern LP cut on vinyl.


One of the reproducers in the display—a Thorens phonograph circa 1905.

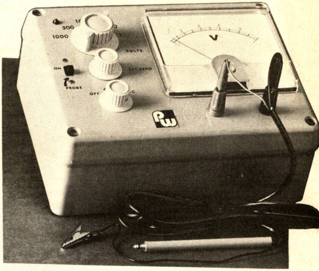
Another century on may well see an exhibition of 1977's music centres and cassette recorders, languishing in chrome and plastic bowers filled with surround sound, but it is questionable whether they will stimulate the imagination or convey as much of the character of the age as these quaint works of wood, metal and mica. They are important because they stirred up the ripples which led to a gigantic tidal wave in human affairs—the crude boxes which paved the way for the world-wide recording industry, and in so doing, opened up one of the most creative extensions of human commercial and artistic endeavour.

Ted Parratt

A WIDE RANGE
VOLTMETER
FOR AC•DC•RF

M.TOOLEY BA G8CKT

A reliable high-impedance DC and AC voltmeter is an invaluable asset in any enthusiast's workshop. The circuit described is simple to use, exhibits excellent linearity and has a constant input impedance of 11MΩ on all ranges. The basic voltmeter is provided with six DC ranges from 1V to 1000V full-scale. A variety of probe designs is included in order to facilitate further DC, AC and RF measurements. The unit is portable and operates from the mains or alternatively it may be powered from an external DC supply. An automatic diode switch is included for changing over from internal to external power.



Circuit Description

A simplified circuit of the DC voltmeter is depicted in **Fig. 1**. This shows the basic bridge configuration formed by Tr2, Tr3, R9 and R10. A constant voltage is developed across R10, the emitter resistor of Tr3. The input voltage, less approximately 0·6V which is the base-emitter voltage drop for Tr2, is effectively developed across R9, the emitter resistor of Tr2. The difference between these two voltages produces a current in the milliammeter, M. The calibration of th instrument is set by the variable resistor, VR1.

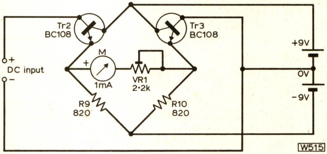


Fig. 1: Simplified circuit of the voltmeter.

★ specifications

Functions: D.C. positive. DC negative.
AC (by means of suitable probe).

Ranges:	1V (full-scale DC)	100V
	10V	500V
	50V	1000V

Input Resistance: 11MΩ without probe or 10MΩ with 1MΩ in probe. (DC)

Supply Voltage: 220/240V 50Hz.
external DC 18 to 24V at 40mA.

Typical Accuracy: DC ±2% AC ±5%

The voltage to be measured is applied to th potential divider formed by resistors R2 to R7, se **Fig. 2**. The voltage division ratio is selected by mean of the Range Switch, S2. A fixed resistor, R1, is pro vided in the input lead. To ensure correct calibratio this resistor is bypassed by means of S3 when a prob is fitted. The output from the potential divider is fe to the FET transistor, Tr1. This transistor is connecte as a source follower and provides a very high inpu resistance and a voltage gain of very slightly les than one.

Transistors Tr2 and Tr3 operate as a balance emitter follower pair. This symmetrical arrangemen ensures good linearity and a high degree of tempera ture stability. The base voltage for Tr3 is fixed a approximately half the DC supply by means of th potential divider formed by R11 and R12. The circui may be balanced by means of VR3 which sets the D potential at the gate of Tr1 and in turn the potentia at the base of Tr2.

The meter connections are reversed to facilitat positive and negative voltage measurements withou the necessity of altering the input lead connections For AC measurements the instrument is effectivel used on the DC negative range and a suitable prob must be employed. The probe is designed to produc a negative DC output using a simple half-wave diod rectifier arrangement. The value of probe resistor, R is chosen so that the instrument is calibrated for RM AC voltages, see table.

Construction

The transistors, Tr1, Tr2, Tr3 and associated components are mounted on a 150 x 115mm 0·1in matrix board, **Fig. 3**. Components and connecting leads are located and soldered on this board by means of press-fit terminal pins. Wire links between pins are made using insulated solid wire. The completed board assembly is mounted below the lid of the plastic box and secured by means of the two meter terminals.

Resistors R2 to R6 are wired directly to the contacts of the Range Switch, S2. Resistor R1 is wired across the contacts of the Probe Switch, S3. Care should be taken to keep wiring as short and neat as possible. The mains transformer is secured to the base of the box, **Fig. 4**, preferably in such a way as to distribute the weight evenly over the base area of the instrument whilst ensuring adequate clearance when the lid and associated components are fitted in place. The external supply sockets are also located in the base of the box, adjacent to the fuseholder. The bridge rectifier and capacitor are fitted to the main circuit board.

Probes

Various probe designs are given in **Fig. 5** together with suitable component values as given in the table. The DC probe of **Fig. 5a** is intended for use when DC voltage measurements are to be made in the presence of AC and RF signals. The 1MΩ probe resistor provides an extra degree of isolation for the circuit under investigation and minimises reactive loading effects. The construction of this probe is shown in **Fig. 6**. The probe circuit is housed in the barrel of a discarded felt-tip pen. The tip contact of the probe makes use of the body of a 3·5mm jack plug which is inserted in the barrel of the felt-tip pen and held in place by means of epoxy adhesive. Only the tip electrical

Table of components for probe designs

Probe	Figure	Component values	Useful voltage range	Useful frequency range
DC	5a	R—1MΩ 0·5 2% high stability metal oxide	0 to 1000V	DC only
AC low voltage	5b	R—3·3 MΩ 2% high stability. C—1μF polyester tubular 250VDC. D—OA91	0·5 to 30V	15Hz to 100kHz
AC medium voltage	5c	R—3·3 MΩ 2% high stability. C—1μF polyester tubular 250VDC D1, D2, D3 OA91	1·5 to 100V	15Hz to 100kHz
RF	5d	R—3·3 MΩ 2% high stability. C—1nF polystyrene 160VDC. D—OA91	0·5 to 30V	100kHz to 100MHz

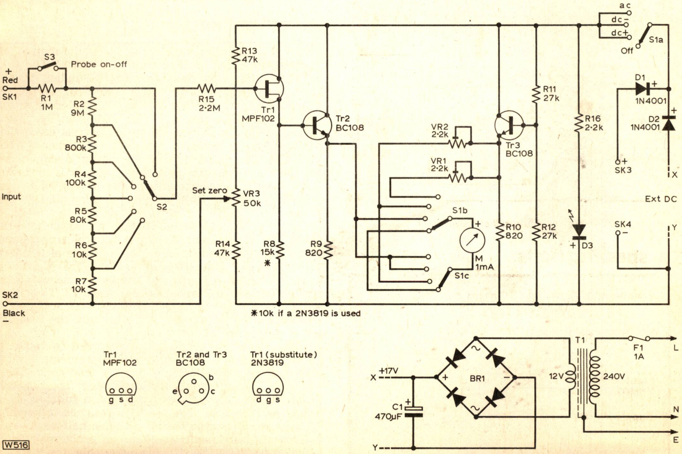


Fig. 2: The detailed circuit diagram, including transistor base connections and optional power supply circuit.

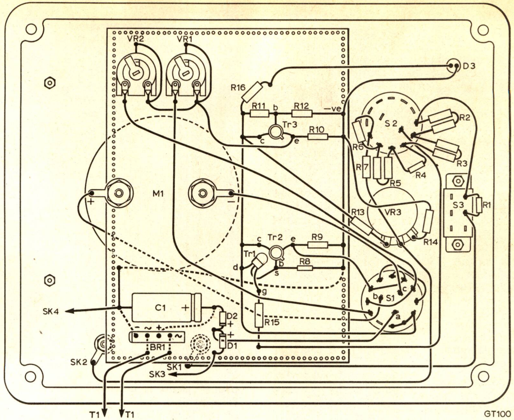
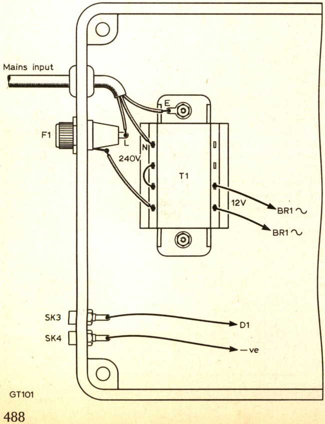


Fig. 3: (above) showing internal layout, and Fig. 4 (below) indicating mains input and transformer details.



★ components

Resistors

R1	1MΩ	R9	820Ω
R2	9MΩ (2·2MΩ + 6·8MΩ)	R10	820Ω
R3	800kΩ (470kΩ + 330kΩ)	R11	27kΩ
R4	100kΩ	R12	27kΩ
R5	80kΩ (47kΩ + 33kΩ)	R13	47kΩ
R6	10kΩ	R14	47kΩ
R7	10kΩ	R15	2·2MΩ
R8	15kΩ	R16	2·2kΩ

R1 to R7 $\frac{1}{2}$W metal oxide high stability 2%
R8 to R16 $\frac{1}{4}$W carbon film high stability 5%
VR1/2 2·2kΩ horizontal pre-set
VR3 50kΩ linear carbon

Semiconductors

Tr1	MPF102	D1/2	1N4001
Tr2/3	BC108	D3	LED (pushfit)
BR1	Bridge rectifier 100PIV 1A		

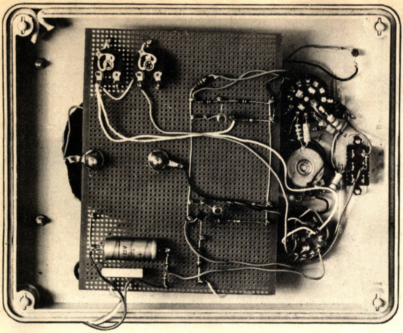
Note: Tr1 may be replaced by a 2N3819 if R8 is changed to 10kΩ. See lead-out connections on Fig. 2.

Switches

S1	3P 4W midget wafer
S2	1P 6W ,, ,,
S3	SPST (or DPDT) slide switch

Miscellaneous

C1, 470µF 25V. Sockets (2), 2mm, red and black. Terminals (2), 4mm, red and black. Mains transformer, 240V to 12V 500mA. Fuse 1A and holder. Meter, 1mA FSD, size depending on readout accuracy required. The author's meter was 117 × 105mm ($4\frac{1}{2}$ × 4in. approx.). Plastic case approx. 225 × 175 × 85mm (9 × 7 × $3\frac{1}{2}$in.).



A view of the inside of the voltmeter, to be used in conjunction with Fig. 3, in which the method of connecting resistors in series to form R2, R3, and R5 is clearly shown.

connection of the jack plug is used, the outer connection is ignored.

A short length (approximately 1m) of coaxial cable is used to couple the probes to the voltmeter. This should preferably be a substantial RF type cable with a copper braided screen. The braid terminates in a short length of stranded wire fitted with a crocodile clip. This ensures a low-resistance contact with the chassis or common rail of the circuit under investigation. The voltmeter end of the connecting cable is fitted with two 4mm plugs. The AC and RF probes use a similar construction technique, **Fig. 7**.

Calibration

Calibration on the DC and AC ranges is carried out by means of VR1 and VR2 respectively. Calibration on the DC ranges may be checked either by the application of an accurately known DC voltage or by reference to another DC voltmeter. If neither is available a new 1·5V cell may be connected to the instrument and VR1 accurately set for a reading of 1·5V, after first remembering to set the Probe Switch "off" and zero the meter! Repeat the calibration procedure for the DC negative and AC ranges (but without a probe connected). Calibration can be checked on the AC range if a known source of AC is available. This may conveniently be a low-voltage transformer of known output supplied from the mains. Do not attempt to calibrate the instrument using AC mains voltage directly since this may cause damage to the probe and to the instrument. The AC probes are suitable only for relatively low AC voltages.

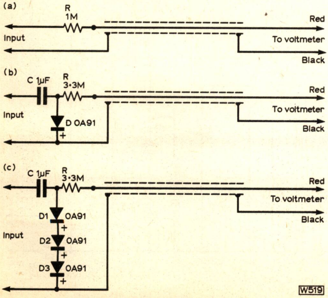


Fig. 5: Suitable probe designs for the unit.

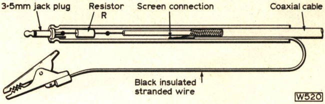
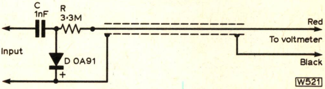


Fig. 6: The construction of the DC probe, (above) and the circuit of the AC and RF probes (below).



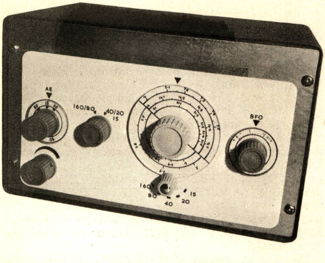
Operation

The voltmeter is switched to the desired Function and the Set Zero control is then adjusted in order to accurately zero the meter. The Range Switch is set to the 1000V range. The input leads are then connected to the circuit under test and the Range Switch is then progressively advanced to the range which produces an easily measurable indication. Note that, for the sake of simplicity, a separate mains switch is not fitted to the instrument. Thus, when the unit is not required for use, it is advisable to disconnect the instrument from the AC supply by removing the mains plug. ●

all band short wave converter

Part 1

F. RAYER G3OGR



The controls are, left to right, RF Tune, Bandswitch, main tuning and BFO Tune. The RF Attenuator/on-off switch is below the RF Tune control at the left.

With a receiver intended particularly for multi-band reception individual coils with parallel and series capacitors are often provided for each range, values being arranged to secure suitable coverage. A bandspreading capacitor suitable for the LF bands is too large in value for the HF bands, so that some ranges need series padders. The number of coils, trimmers and padders for a multi-band receiver of this type becomes large and careful adjustment is needed to track aerial and oscillator tuning.

The converter described here avoids these difficulties, and is in line with the trend to use a high intermediate frequency, to eliminate second channel interference. It is suitable for operation with a receiver tuned to about 5·5MHz, which will be available with many general coverage receivers, and allows 1·8 to 21MHz to be covered with a single converter oscillator coil.

Although this article describes a converter intended for use on the amateur bands there is no reason why it should not be aligned for the SW broadcast bands, since most of these bands are adjacent, in terms of frequency, to the amateur bands.

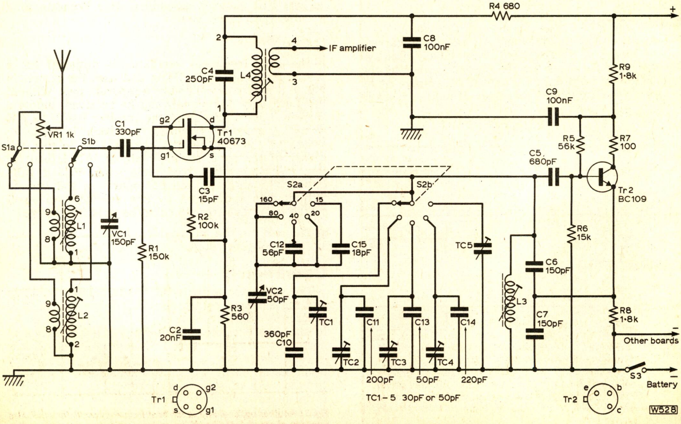


Fig. 1: Circuit diagram showing the mixer and oscillator sections of the converter, together with the lead-outs for the transistors.

Circuit Description

Fig. 1 shows the mixer and oscillator stages. The ganged switch S1a/S1b brings into circuit either L1 or L2 for aerial tuning, L1 covering the 15, 20 and 40m bands, and L2 the 80 and 160m bands. Each band is peaked by the panel control VC1. This provides five bands with two coils, with no trimming or similar alignment difficulties.

L3 is the oscillator coil, tuned by VC2, with the switch S2a/S2b. This switch has five positions, operating as follows:—

160m VC2 has C10 and TC1 in parallel, so that the oscillator coverage is 7·25 to 7·5MHz. With the 5·5MHz IF, this gives reception over the 1·75 to 2·0MHz range.

80m C11 and TC2 are in parallel with VC2, giving an oscillator coverage of 9 to 9·5MHz, or 3·5 to 4·0MHz on reception.

40m C13 and TC3 are across L3, and C12 is in series with VC2. Oscillator coverage is 12·5 to 13MHz, giving reception of signals in the 7 to 7·5MHz band.

20m C14, TC4 and VC2 are in parallel, so that L3 tunes 8·5 to 9MHz and reception is from 14 to 14·5MHz.

15m TC5 is across L3 and C15 is in series with VC2, giving an oscillator range of 15·5 to 16MHz, for reception over 21 to 21·5MHz.

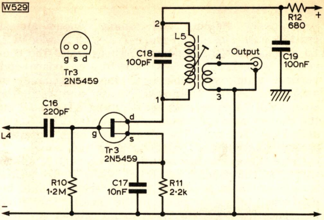


Fig. 2: The optional IF amplifier stage which works at 5·5MHz. This is a separate unit, and may be fitted if the main receiver is relatively insensitive.

VC2 is operated by a ball drive and is the main tuning, with VC1 peaking signals as mentioned. VC1 is calibrated to avoid tuning to second channel frequencies, which arise at about 11, 13, 15 and 18MHz in the usual way with a 5·5MHz IF. VR1 is an attenuator or aerial input control, enabling the strength of signals to be kept down so that satisfactory CW and SSB reception can be obtained, also preventing the overloading of the receiver with strong AM transmissions. Tr1 is the mixer, with the signal input to gate 1, and the oscillator input to gate 2. Tr2 is the oscillator stage, operating as described. L4 is tuned to approximately 5·5MHz and is followed by an optional FET 5·5MHz stage. This can be omitted with a reasonably sensitive main receiver, or can be added later. A BFO is included to allow CW and SSB reception with the popular type of receivers which may have no beat frequency oscillator incorporated.

★ components

Resistors

R1	150kΩ	R6	15kΩ	R11	2·2kΩ
R2	100kΩ	R7	100Ω	R12	680Ω
R3	560Ω	R8	1·8kΩ	R13	390kΩ
R4	680Ω	R9	1·8kΩ	R14	6·8kΩ
R5	56kΩ	R10	1·2MΩ	R15	2·7kΩ

VR1 1kΩ linear carbon with switch S3

All resistors are ¼ or ⅓W 5%

Capacitors

C1	330pF	C9	100nF	C17	10nF
C2	20nF	C10	360pF*	C18	100pF*
C3	15pF	C11	200pF*	C19	100nF
C4	250pF*	C12	56pF*	C20	10nF
C5	680pF	C13	50pF*	C21	220pF*
C6	150pF*	C14	220pF*	C22	220pF*
C7	150pF*	C15	18pF*	C23	470μF 12V
C8	100nF	C16	220pF		

*2% silver mica preferred

TC1/5	50pF trimmer	VC1	150pF (Jackson C804)
VC2	50pF (C804)	VC3	20pF (C804)

Semiconductors

Tr1	40673	Tr3	2N5459
Tr2	BC109	Tr4	2N2926

Miscellaneous

S1, 2-pole 2-way wafer switch. S2, 2-pole 5-way wafer switch. L1, Yellow, Range 4, valve type (Denco). L2, White, Range 2, valve type (Denco). L3, 4, 5 and 6, see text. 11mm coil former with core, 1 off. 7mm coil former on square base, with core, 3 off (Home Radio). Square screening can for L5. Coaxial sockets, 2 off. Ball drive, 6 : 36 ratio (Jackson). Knobs. Panel brackets. Chassis, 8 × 6 × ½". Cabinet, 10 × 6 × 6". Plain veroboard 0·15" matrix, *see text.*

Fig. 2 is the circuit of the 5·5MHz optional stage. Signal input is taken from Tr1 coupling coil L4 pin 4, to C16. L5-C18 is a further 5·5MHz coil connected in the drain circuit of Tr3, and coupled to the output socket. This stage is assembled as a separate unit, fitted to the chassis later.

BFO

The beat frequency oscillator is designed for a centre frequency of 5·5MHz and uses the circuit in **Fig. 3**. It is also assembled as a separate unit. Without the BFO, only AM signals can be received, unless a suitable BFO is present in the receiver itself. As AM reception may be required, provision is made to switch off the BFO for this purpose. To do this, the corner of the back moving plate of VC3 is bent so that it contacts the fixed plate when VC3 is fully closed. The stage is then not operative and current is limited to about 1mA by R14 and R15. An on-off switch in series with R15 could be used if preferred.

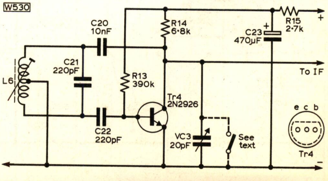


Fig. 3: Another optional unit is the beat frequency oscillator which also operates at about 5·5MHz. If the main receiver has a BFO then this unit is not required.

Construction

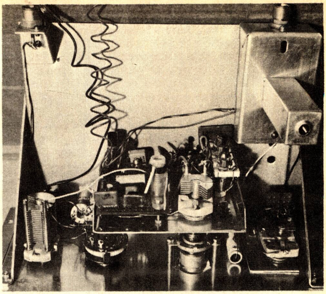
Frequency stability and tuning depend almost entirely on the oscillator stage Tr2, with S2a/b, VC2, L3 and associated components. This part of the converter, with Tr1, occupies a perforated board and vertical panel, set back from the main panel to accommodate the ball drive. Mixer and oscillator stages will be completed by mounting L1 and L2 on the chassis near the panel, which carries VR1, S1a/b and VC1. Tr3 and Tr4 stages are each separate assemblies, mounted on the chassis and panel.

Only a very shallow chassis is necessary, as no wiring or components are fitted below it. To secure a rigid assembly, a pair of panel brackets should be used when fitting the panel to the chassis. The latter has space for a 9V battery. A metal cabinet is essential helping to avoid direct breakthrough of 5·5MHz signals.

The converter can be tested when the wiring in Fig. 1 is complete (for AM reception only if the receiver has no BFO). To do this, connect pin 4 of L4 to the receiver's aerial terminal.

Oscillator-Mixer Board

This is approximately 72 x 48mm, and is shown in **Fig. 4.** L3 has seven turns of 26SWG enamelled wire, close wound, on a $^7/_{16}$in or 11mm diameter former, with adjustable core. The winding is near the top of the former and the core is initially set so that its top is just entering the bottom of the winding. Turns are cemented in place.



The assembly at centre front holds the mixer-oscillator board together with the paxolin strip on which the five oscillator trimmers are mounted. The optional IF stage is at the back, right.

L4 is wound with 32SWG enamelled wire on a $^9/_{32}$in or 7mm dia former with core. Secure the wire at the bottom for point 1, and wind twenty-three turns, secure with a little adhesive, then cut off to form point 2. Leave a small space, say 1mm, and wind on the secondary, points 3 to 4, which has six turns. (As L5 in **Fig. 7**).

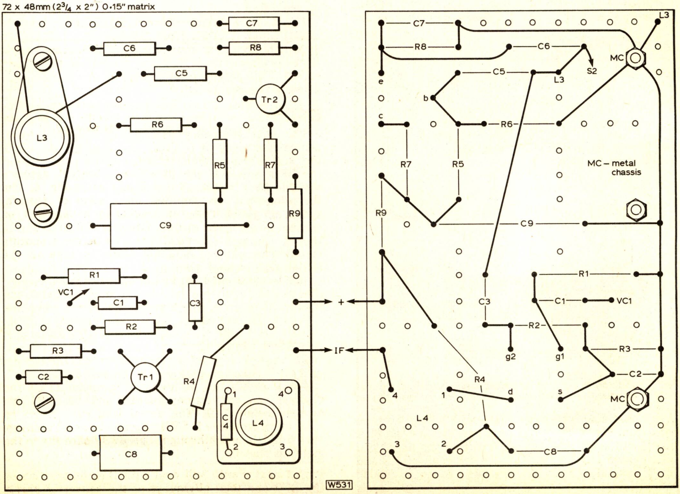


Fig. 4: The two sides of the mixer-oscillator board. The details of the coils L3 and L4 are in the text.

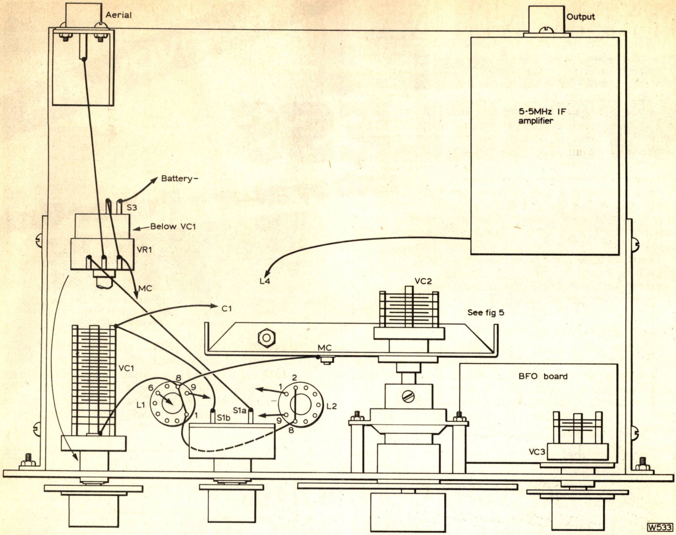


Fig. 6: Layout of the units and main components on the chassis. After the main tuning dial has been fitted to the panel the remaining panel components can be mounted in the same line.

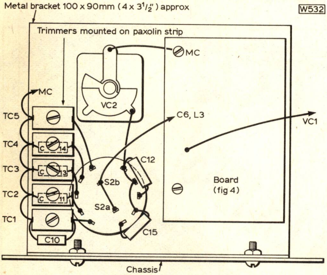


Fig. 5: Details of the assembly mentioned in the photograph. It can be finished completely as shown before mounting on the main chassis.

The positions of components and wiring can be seen from **Fig. 4**. The chassis returns MC are ½in 6BA bolts, with extra nuts and tags, so that the board can be mounted later with clearance for connections and leads. Insulated leads are provided to go to S2a/b, VC1, positive, and output socket or IF stage. Leads of Tr1 and Tr2 are shown in **Fig. 1**.

Osc/Mixer assembly

VC2 and S2a/b are fitted to a bracket approximately 100 x 90mm (4in x 3½in) as in **Fig. 5**. The five trimmers are mounted on a strip of paxolin, which is spaced from the bracket by a long bolt, or similar, to clear the switch. Connect C10 to TC1, C11 to TC2, C13 to TC3, and C14 to TC4 before mounting the trimmer strip, including leads to take to the switch tags on that side.

The board is mounted by the bolts described earlier. The switch requires a spindle 2in long, so that it can project through a ¼in hole in the panel, when the assembly is bolted in place approximately 1½in behind the panel. Alternatively, a shaft coupler can be added, with a length of rod. The exact distance from bracket to panel is arranged so that the spindle of VC2 engages correctly with the ball drive bush.

Fig. 6 shows the positions of components on the chassis, and connections for L1 and L2. VR1 fits directly below VC1. The aerial lead runs direct to VR1, away from the 5·5MHz circuits to avoid unnecessary 5·5MHz breakthrough. The BFO board fits to the right, as shown.

Part 2 next month will deal with the construction of the BFO and final alignment of the converter plus a few hints on using the converter.

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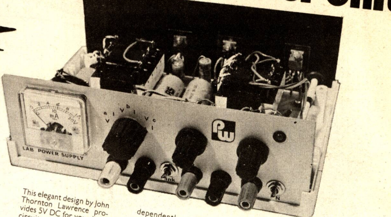

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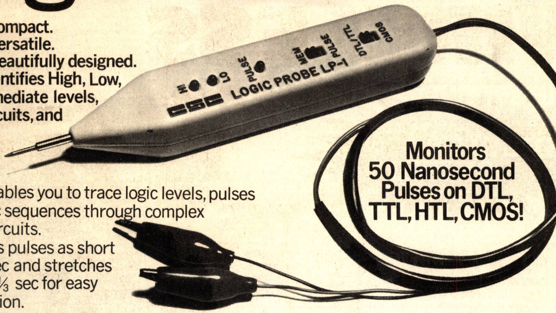

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DTL/TTL Thresholds:
logic 1, 2.25V ± 0.15
logic 0, 0.80V ± 0.10
HTL/CMOS Thresholds:
logic 1, 1,70% Vcc
logic 0, 0,30% Vcc
Min. detectable pulse:
50 nanoseconds
Max. input signal frequency:
10MHz
Power requirements:
5 Volt Vcc, 30mA
15 Volt Vcc, 40mA
36 Volts max.
Size: 6.1 x 1.0 x 0.7 inches
(155 x 25 x 18mm)
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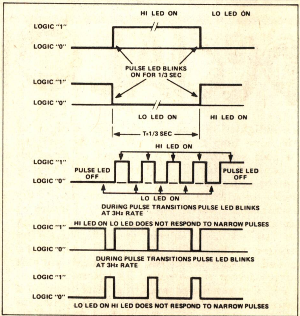
Power leads: 24 inches (610mm), colour coded.


HI LED ON
LO LED ON
LOGIC "1"
LOGIC "0"
PULSE LED BLINKS ON FOR 1/3 SEC
LOGIC "1"
LOGIC "0"
LO LED ON
HI LED ON
T=1/3 SEC
HI LED ON
LOGIC "1"
PULSE LED OFF
LOGIC "0"
PULSE LED OFF
LO LED ON
DURING PULSE TRANSITIONS PULSE LED BLINKS AT 3Hz RATE
LOGIC "1"
HI LED ON LO LED DOES NOT RESPOND TO NARROW PULSES
LOGIC "0"
DURING PULSE TRANSITIONS PULSE LED BLINKS AT 3Hz RATE
LOGIC "1"
LOGIC "0"
LO LED ON HI LED DOES NOT RESPOND TO NARROW PULSES

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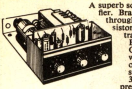

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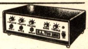

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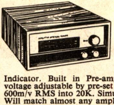

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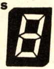

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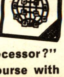

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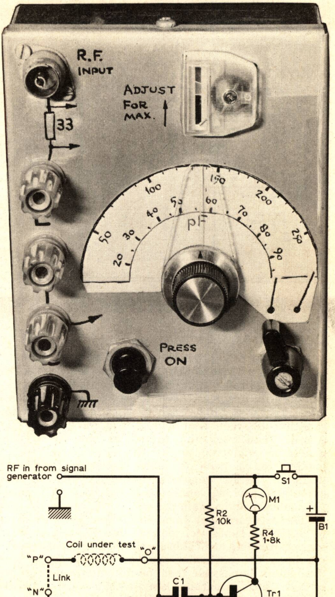
This resonance indicator is not intended to replace more accurate (and more expensive!) apparatus, but rather to provide a rapid method of checking unknown tuned circuits in the range 100kHz to 28MHz. With a given inductor in circuit, the values of unknown capacitors may be found within the range of VC1a and b by resonating the inductor at the same frequency, first with and then without the unknown capacitor between terminals N and M. The change in the value of VC1a or VC1b needed to re-establish resonance is therefore the value of the unknown capacitor.

Circuit operation

In a series tuned circuit **maximum** current flows at resonance and in **Fig. 1** this current through R1 feeds the emitter of Tr1 with an increased RF voltage compared with the voltage at other frequencies. The emitter and base of Tr1, just biased on by R2, VR1, form a detector circuit and the boosted RF thus acts to increase the emitter-base current. The resulting increase in collector current is indicated by the meter so that the resonance of a particular coil with a selected capacitance and frequency is now known.

Construction

Because a variable capacitor usually has the frame earthed, this has to be fitted at the 'bottom' of the circuit and the operational electronics are therefore at the 'live RF' end, as is the push-button on-off switch. All components apart from R1, S1, S2, VC1 and M1 may be fitted to a piece of Veroboard; VR1 is adjusted to give a small (about 20 per cent) pointer deflection when S1 is closed. R1, a carbon type, is fitted directly from the coaxial RF input socket to terminal O to limit excess inductance; the circuit board could be attached across R1 by short stiff wires if one wishes to avoid making additional fixings to the chassis or panel. **See Figs. 2 and 3.**



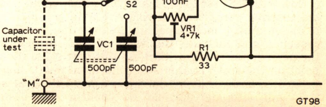


Fig. 1: The circuit diagram of the RF Resonance Indicator.

VC1 is bolted direct to the case. A metal case is recommended rather than a plastic one. A short pointer on the shaft traverses over a card scale glued to the outside of the box. During construction ensure that the link between terminal N and P is easily removed for ease of calibration.

The single Mallory cell (in its holder) may be glued into place, and should last for several years.

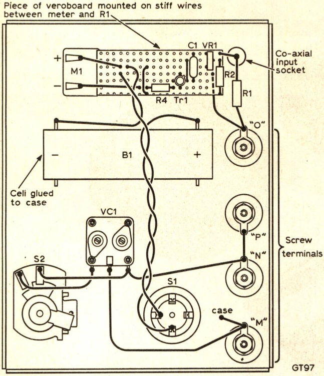


Fig. 2: General wiring inside the aluminium case.

Calibration

Connect a coil (fifteen turns of plastic or enamel covered wire close-wound and taped securely to a ferrite aerial rod will do) between terminals P and O. Temporarily unsolder the link N-P. Connect a close-tolerance 50 or 100pF silver mica or polystyrene capacitor between terminals N and M, keeping S1 closed. Then vary the tuning of the RF signal generator connected to the RF input socket while looking for a peak in meter deflection. Without changing the RF generator frequency, remove the external capacitor, connect N-P and vary VC1 until the meter reading again peaks.

The scale-card may then be marked with its first 50 or 100pF calibration point. Close S2, retune VC1 for peak reading and calibrate the other scale. Depending upon the particular type of variable capacitor available it is possible that the minimum capacitance of both gangs in parallel is more than 50pF and that 100pF will be the first calibration.

Now with VC1 set to the 50pF calibration point, add the external capacitor and vary the input frequency to obtain a peak meter reading. Remove the external capacitor and increase the value of VC1 to regain the peak meter reading, marking this new calibration point on the scale. In this way calibration points may be located at 50 or 100pF intervals around the scales.

It will also be possible to confirm the basic frequency formula that if the 15-turn coil resonates at about 5 to 6 MHz with 50pF, then at 450pF, **nine times** the original capacitance, the resonant frequency becomes **one-third** of its value at about 1·8MHz. This is because resonance is proportional to the **square-root** of the ratio of capacitance change. ●

★ components

Resistors: R1 33Ω, R2 10kΩ, R4 1·8kΩ. VR1, 4·7kΩ preset.

Capacitors: C1 100nF polycarbonate. VC1, 500/500pF gang capacitor

Transistor: BC108

Switches: S1, push-to-make switch. S2, SPDT wafer

Miscellaneous: Screw-type terminals. Co-axial socket. Metal case, 5½" × 4¼" × 1¾" (140mm × 105mm × 45mm). (AB10) B1: 1·2V to 1·5V cell (mercury). Piece of Veroboard, 2" × 1" (50mm × 25mm).

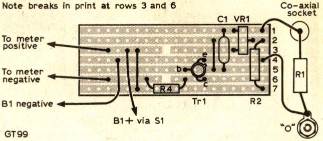
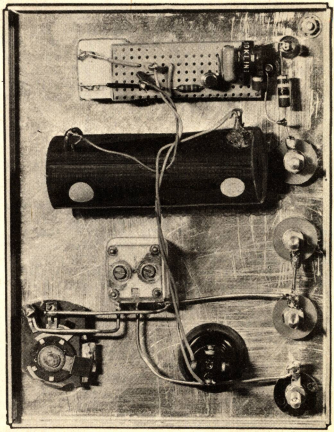


Fig. 3: Showing the component positions on the Veroboard, and meter and battery interconnections.



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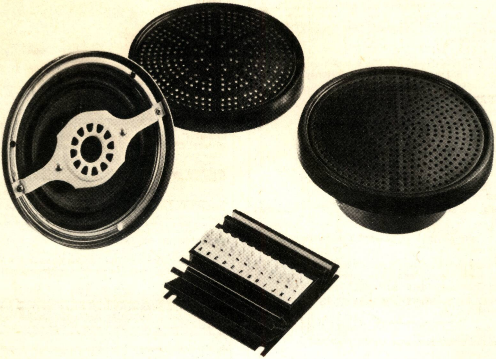

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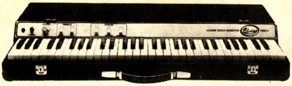

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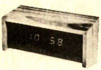

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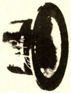

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So you want to pass the R.A.E. (Radio Amateurs' Examination)?

No.3

John Thornton Lawrence GW3JGA & Ken Mc Coy GW8CMY

The passing of the Radio Amateurs' Examination, set by the City and Guilds, requires a certain level of theoretical technical knowledge. Whether one considers that this level is too high or too low is beside the point. The course that follows is intended, with the help of certain external aids, to prepare the reader to pass the examination. It will not teach him all about electronics!

Practical Ohm's Law

Before we move off Ohm's law and resistance, let us see how it can be applied to calculating the resistor values in a practical circuit. We are going to use an audio frequency amplifier as an example and this is shown in **Fig. 1a.** As we are only concerned with the DC conditions and how they are set up, we can forget about all the AC components, the coupling and de-coupling capacitors, leaving only the DC components as shown in **Fig. 1b.** Most modern small signal transistors have a beta (DC gain) of 100 or more, this implies a very small base current, sufficiently small that it may be ignored altogether if certain "rule-of-thumb" conditions are observed.

In a small signal audio frequency transistor amplifier stage, the collector current for optimum gain, noise performance, etc., would be about 1 to 2mA, so for simplicity we will choose 1mA (10^{-3}A). Now for the current flowing down the base potential divider, R1 and R2. As a rule-of-thumb guide this should be a tenth of the collector current, so in our circuit it would be 0·1mA (10^{-4}A). This ensures that this current is large compared with the small bias current of the transistor. The two currents are shown in **Fig. 1b.**

Now for the voltages in the circuit. First we must know the supply voltage, so for our example we will make this 9V. The emitter resistor R4 provides stabilisation of the operating conditions for Tr1. A typical voltage drop across this would be 0·5 to 1V. So again for simplicity we will choose 1V. The collector voltage should sit midway between the emitter voltage +1V and the supply voltage +9V, that is at +5V. This will allow a signal voltage swing on the collector to go positive by 4V to the supply voltage and negative by 4V to the emitter voltage. Remember, up the page is more positive and down the page is more negative (away from positive)! Finally, the voltage drop across the emitter-base of a silicon transistor is 0·6V so if the emitter is at +1V the base will be at +1·6V.

Now for the sums to work out the value of the resistors, these are taken in reverse order.

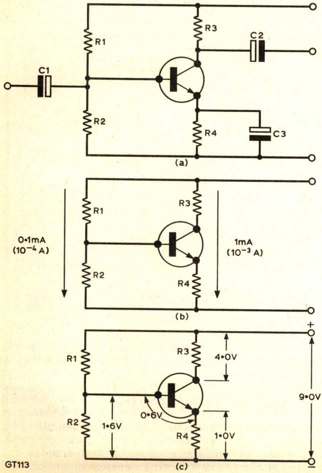
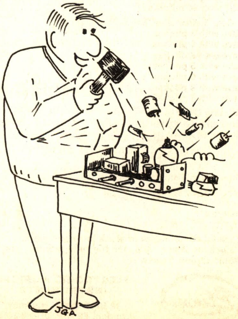


Fig. 1: The application of Ohm's Law to a simple transistor circuit.



. . . some practical experience is desirable!

$$R4 = \frac{V}{I} = \frac{1V}{10^{-3}A} = 10^3\,\Omega = 1k\Omega$$

$$R3 = \frac{V}{I} = \frac{4V}{10^{-3}A} = 4 \times 10^3\,\Omega = 4k\Omega$$

$$R2 = \frac{V}{I} = \frac{1{\cdot}6V}{10^{-4}A} = 1{\cdot}6 \times 10^4\,\Omega = 16k\Omega$$

$$R1 = \frac{V}{I} = \frac{9-1{\cdot}6V}{10^{-4}A} = \frac{7{\cdot}4V}{10^{-4}A} = 7{\cdot}4 \times 10^4\,\Omega = 74k\Omega$$

In a practical circuit the value of each resistor would have to be chosen from the list of "preferred" values. There are 12 "preferred" values in each decade of the 10% tolerance range of resistors and 24 "preferred" values in the 5% range.

10% (E12) range:—
1·0, 1·2, 1·5, 1·8, 2·2, 2·7, 3·3, 3·9, 4·7, 5·6, 6·8, 8·2.

5% (E24) range. All the above values plus:—
1·1, 1·3, 1·6, 2·0, 2·4, 3·0, 3·6, 4·3, 5·1, 6·2, 7·5, 9·1.

To complete our exercise let us now specify the preferred values for our circuit.

	R1	R2	R3	R4
Calculated value	74kΩ	16kΩ	4kΩ	1kΩ
5% range (E24)	75kΩ	16kΩ	3·9kΩ	1kΩ
10% range (E12)	68kΩ	15kΩ	3·9kΩ	1kΩ

Magnetism

We are not proposing to spend any time on permanent magnets except to say that a permanent magnet has a "north seeking" pole and a "south seeking" pole and that imaginary lines of magnetic field or force run from the north to the south pole of the magnet. If two magnets are brought close together then the poles attract one another if they are dissimilar, N-S or S-N, and repel one another if they are similar, N-N, S-S. (See Radio Amateurs' Examination Manual, page 9).

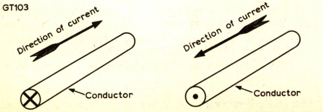
If you are a family man, perhaps you could borrow your son's copy of the Ladybird Book, "Magnets, Bulbs and Batteries"! Seriously though, it's an excellent little book and illustrates pictorially the effects we are going to discuss.

Magnetic Effect of an Electric Current

In the following section we shall look at the magnetic effects produced by currents flowing in conductors. When illustrating these effects in diagrams it is essential to know the direction in which the current is flowing and the way this is done is shown in **Fig. 2**. A cross on the conductor relates to the flight of the arrow and indicates that the current is flowing **away** from the observer and a dot on the conductor represents the point of the arrow and indicates that the current is flowing **towards** the observer.

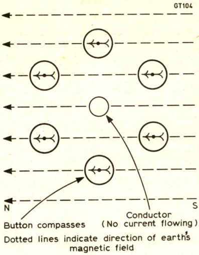
Now, let's get down to business and look at a conductor in cross section as shown in **Fig. 3**. The conductor is surrounded by button compasses, no current is flowing and the compasses are taking up a position in line with the earth's magnetic field. When current flows through the conductor away from you, as shown in **Fig. 4a**, a magnetic field is produced and the compasses align themselves with the lines of this field, in a clockwise direction. When the current flows in the reverse direction, towards you, as shown in **Fig. 4b**, you can see that the direction of the magnetic field is also reversed. Remember, reversal of the current produces a reversal of the field.

Fig. 2



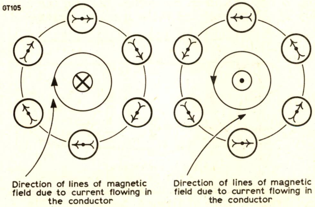
Current flowing "Into" page

Current flowing "Out" of page



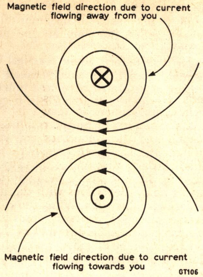
▲ *Fig. 3*

▼ *Fig. 4*


GT105
Direction of lines of magnetic field due to current flowing in the conductor
Direction of lines of magnetic field due to current flowing in the conductor

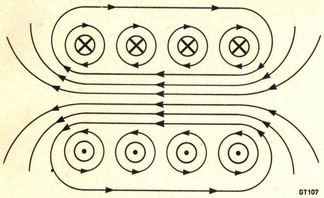
The Solenoid

If a conductor is formed into a single turn coil, a cross-section view would appear as shown in **Fig. 5**. You will now notice that the magnetic fields produced in the centre of the coil are in the same direction and are, therefore, more concentrated. The solenoid is a coil comprising a number of turns, as shown in section in **Fig. 6**. Here you can see the overall effect of the lines of magnetic field around each conductor, combining to produce a concentrated field in the centre of the solenoid, with an overall magnetic field similar to that produced by a permanent bar magnet


Magnetic field direction due to current flowing away from you
Magnetic field direction due to current flowing towards you
GT106

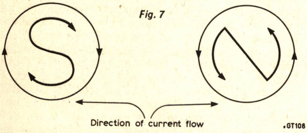
▲ *Fig. 5*

▼ *Fig. 6*



with its "north seeking" pole and "south seeking" pole. The magnetic polarity of the solenoid can be deduced by observing the direction of the current flow when viewing the coil at one end, as shown in **Fig. 7**. *The arrows on the letters indicate the direction of the current and make a useful memory aid.*

Fig. 7



Now, suppose we place a conductor in a magnetic field, with no current flowing, as shown in **Fig. 8a**, there is no disturbance to the field. When a current flows through the conductor, its resultant magnetic field reacts with the existing field, as shown in **Fig. 8b**. You will see that on one side of the conductor the lines of magnetic field are in the same direction as those produced by the current and tend to reinforce the field on that side whilst on the other the fields tend to cancel out. This causes a force to be exerted on the conductor resulting in its moving in the direction indicated. A reversal of current produces a reversal in the direction of movement, as shown in **Fig. 8c**.

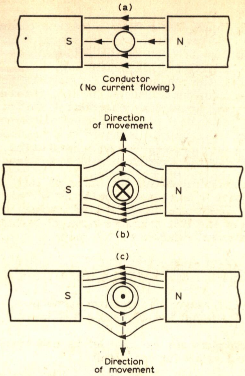


***Fig. 8**: Physical effect of current flowing in a conductor situated in a magnetic field.*

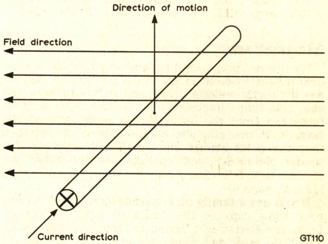


***Fig. 9**: Effect on a conductor when it is moving in a magnetic field.*

Finally, let us look at the converse of this effect where the conductor is moving at right angles to a magnetic field, as shown in **Fig. 9**. Here a flow of current is INDUCED in the conductor and its direction depends on the direction of the motion. *The memory aid for this, which is Fleming's Left Hand Rule, is illustrated in* **Fig. 10**.

The Left Hand Rule

If the thumb, forefinger and second finger of the Left hand are placed at right angles to one another,

(i) The *Forefinger* indicates *Field* direction.
(ii) The *ThuMb* indicates *Motion* direction.
(iii) The *SeCond* finger indicates *Current* direction.

So that, if we know any two of the three directions, the third can be found.

To summarize what we have seen in this section,

(i) If we pass current through a conductor a magnetic field is set up around it.
(ii) The direction of the field depends on the direction of the current flow.
(iii) If the conductor is in a magnetic field and a current is made to flow in it, the conductor will move, the direction of motion being dependent on the direction of current flow.
(iv) If a conductor is moved in a magnetic field, then a current will be *induced* in the conductor, the direction of which is dependent on the direction of motion.

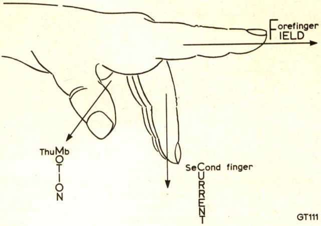


Fig. 10: Illustration of Fleming's Left Hand Rule. The importance of memorising this rule cannot be stressed too strongly.

You may begin to wonder what on earth all this has to do with amateur radio, so we will explain that the relationship between the direction of the current flowing in the conductors and the resulting magnetic field, together with the rate at which a conductor is moved in a magnetic field, are all basic ideas related to the generation of Alternating Current (AC).

Electromagnetic Induction

In the previous section you will have noticed the term INDUCED current, or a current produced by electromagnetic induction. This effect can best be demonstrated by means of the interaction of a bar magnet and a solenoid, **Fig. 11.** If the bar magnet is moved into the solenoid a deflection will be noticed in the meter connected between the ends of the windings. When the bar magnet is removed a deflection will be noticed again, but this time in the opposite direction. *Whilst the magnet is stationary, no deflection will be observed.* As an aside, you will also notice the fact (and by no means an insignificant one) that the faster you move the magnet, the greater the meter deflection.

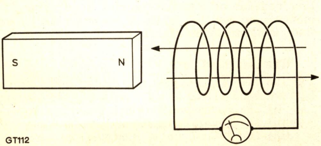
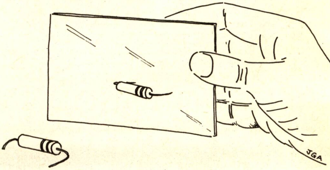


Fig. 11: A practical experiment which will show that a current is generated when a bar magnet is inserted into or removed from a solenoid. Remember:—No movement, no current!

As we have said before, some practical experience is very desirable, so why not wind yourself a solenoid, 50 to 100 turns of insulated wire on a toilet roll tube, connect it to a milliammeter, push in a magnet and see what happens!

The meter deflections indicate the presence of a potential difference between the ends of the solenoid conductors, giving rise to INDUCED current. If we think about this for a minute we will remember that, while current is flowing in the solenoid, that current will produce a magnetic field. Now, the direction of that field will be such as to oppose the motion of the magnet which induces it. Thus, if the north pole of the magnet is pushed inside the solenoid the current flow induced will produce an apparent north pole at that end of the solenoid, thus tending to oppose the magnet's motion. As the magnet is withdrawn the induced current will produce an apparent south pole at that end of the solenoid, again opposing the extraction of the magnet, since a north pole will attract a south pole.



. . . what is meant by "reflected impedance"?

The German physicist Lenz formalised this in his Law in 1834. Basically it means that the direction of the induced potential difference tends to set up a current opposing the motion or change of magnetic field producing that potential difference. Now the magnetic field which is used to induce currents in a solenoid need not come from a permanent magnet. It could come from another solenoid placed in close proximity to the first. In this we have the bones of the TRANSFORMER, but, before we look at that subject, the question of the nature of ALTERNATING CURRENT (AC) arises. Again, the previous sections will be of assistance since AC is best understood when reference is made to the facts relating to conductors moving in a magnetic field.

To be continued next month

Readers are asked to note that the publications mentioned already in this series as recommended reading have recently been increased in price. They are "A Guide to Amateur Radio" and "The Radio Amateurs' Examination Manual" which now cost £1·38 and 86p respectively. They are obtainable from the Radio Society of Great Britain, 35 Doughty Street, London WCI. The prices are inclusive of postage.

THE PW 'jubilee' ELECTRONIC ORGAN

Part 3

M. J. HUGHES, MA, C.Eng., MIERE

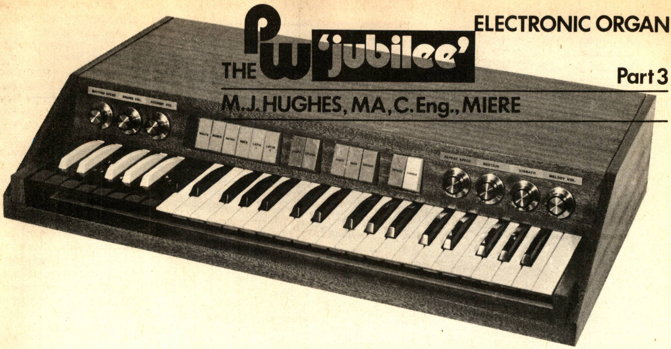


Fig. 1 shows the melody keying, percussion, sustain and tone forming circuits in their entirety. ICs 7, 8 and 9 are the priority encoders described in *Part 1*. They receive the 37 tones from the generators on pins 16 to 27 in the case of ICs 7 and 8, and 15 to 27 for IC9. There are 13 inputs to the latter to allow for bottom C. Single lines to each keyboard contact can be seen clearly. When one of these lines is pulled to ground through the respective switch, the note associated with that key is latched and fed out at pin 9. The links between the ICs give priority to the highest note played.

Melody Circuits

The high level signals generated at the outputs of the priority encoders are fed to potential divider (R11 and R12) which reduces them to a level less than Vbe for Tr3 which is connected as an emitter follower. If there is no bias at the base of this transistor the audio signal will not appear at the emitter; the rate of application and removal of bias at this point controls the envelope of the output signal—thence the duration of sustain. If S1 and S2 are closed the priority output from IC9 (pin 31) is routed through the three cascaded gates of IC11b, c and d, and eventually appears, at reduced level, across VR5. A proportion of this is fed through D2 to the base of Tr3 providing the bias necessary to allow the audio signal to appear at its emitter. C6 creates a slight time constant, in conjunction with the setting of VR5, to introduce attack in the envelope.

When the selected key is released the priority signal falls immediately to zero but D2 becomes reverse biased allowing a charge to remain on C6. This charge keeps Tr3 (which can be considered to be an analogue gate) open and the audio continues to appear at its emitter. Over a short period the DC charge on C6 leaks away through Tr3 as base current and the bias is slowly lost. As this happens the audio signal at the emitter dies away. Because the signal is a square wave to start with there is no distortion in this operation. The period of charge leakage sets the sustain duration and this can be controlled by adjustment of VR6 which sets the base current for the transistor. This latter control is brought out to the front panel.

S2 introduces a low-leakage tantalum capacitor into the path of the keying strobe. This differentiates the control signal for Tr3; this opens the analogue gate momentarily allowing a short burst of audio through. The sustain setting controls the rate at which this percussive burst dies away. The burst of audio occurs on the depression of the key and will not sound again until the key is released and pressed again.

IC10 is the repeat percussion oscillator, frequency controlled by VR4 (again a front panel control). When S1 is open the low-frequency pulses of this oscillator are fed through IC11a and pass through the following gate when a key is depressed. Instead of getting a steady DC level at pin 10 of IC11d, the keying signal is now chopped by the repeat signal. This creates note repetition. Using this in conjunction with the sustain control produces effects such as banjo or xylophone sounds. Note that C7 should be a tantalum capacitor.

The RC circuitry following Tr3 creates the voicing. Normally S3, 4 and 5 are closed which shorts the signals to ground. Opening one or more of these switches introduces a particular tone colour. The signals of these three options are mixed by R21, 23 and 26 before being fed to the front panel "Melody Volume" control and thence to the melody buffer amplifier with gain set by VR8. This signal is then fed to the power amplifier or phono output stage.

Use Soldercon sockets for ICs 7 to 9 but do not insert the integrated circuits. Complete the assembly of the rest of this section by reference to **Fig. 2**. To facilitate testing, solder temporary links across the pairs of pins which will eventually go to S1 and S2. At the same time, temporarily wire in VR4, VR6 and VR7. Set the potentiometers and presets as follows to start with: VR4 Midway, VR5 To bottom (ground) end, VR6 To bottom end, VR7 Midway, VR8 Midway.

Insert the tone generator ICs. With a couple of lengths of wire fitted with clips, select one of the tone lines (see last month's circuit) and hook it tem-

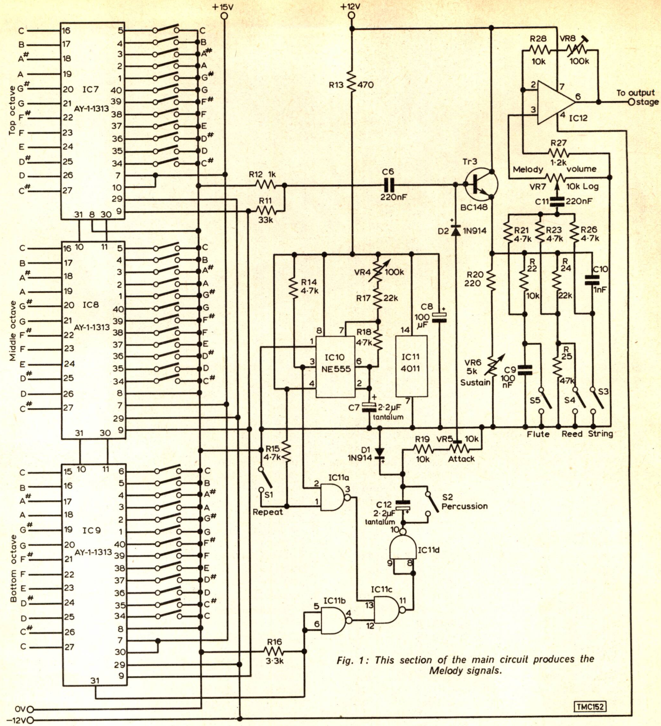


Fig. 1: This section of the main circuit produces the Melody signals.

porarily to the end of R11 which goes to the priority encoders. This will provide a test signal. The other wire should have one end clipped to pins 5 and 6 of IC11 (the end of R16 going to this point will do). The other end of this wire simulates keying by touching it to the +12V rail (at the positive end of C8).

Connect the power supply as described last month plus a loudspeaker. When you apply power you should hear nothing. Next hook the keying wire to +12V and you should still hear nothing. Gently adjust the wiper of VR5 away from the bottom end of its track to produce a tone in the loudspeaker. Adjust VR5 until the tone just reaches a stable level (ie does not get louder with increase of the setting). If, at this stage the volume is uncomfortably loud or is distorting, reduce the value of VR8. Remove the keying wire from the 12V source and the tone should stop immediately. Slowly advance VR6 and tap the keying wire on and off the 12V point. The sustain effect should get greater as VR6 is increased in value. If you get an unpleasant click at each contact with the keying point, you have probably advanced VR5 too much—this setting is fairly critical.

Remove the link across the pins for S2 and try the keying test. You should get the single burst of sound when the keying contact is made. Finally remove the link across the pins for S1. This time, when you key, you should hear repeated percussive bursts of sound—rate adjustable by VR4.

Turn off the power and remove all temporarily connected potentiometers and *also remove IC12 or it will be impossible to test following stages.*

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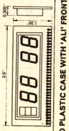

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W 01	·31	M 01	·49	S 02	·42	T 01	·54
W 02	·35	M 02	·50	S 04	·49	T 02	·57
W 04	·44	M 04	·52	S 06	·55	T 04	·63
W 06	·55	M 06	·57	S 08	·62	T 06	·70
W 08	·60	M 08	·61	S 10	·89	T 08	·85
						T 10	1·25

6 AMP.		10 AMP		25 AMP.		Voltages	
PW 01	·70	J 005	1·30	K 005	1·38	005	50V
PW 02	·74	J 01	1·36	K 01	1·48	01	100V
PW 04	·80	J 02	1·56	K 02	1·70	02	200V
PW 06	·90	J 04	1·94	K 04	2·10	04	400V
PW 08	1·00	J 06	2·35	K 06	2·60	06	600V
PW 10	1·50					08	800V
						10	1000V

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SS3	Thyristor Triac-Diac-UJT-PUT Data Book and Equivalent Manual	THT 77	4·50
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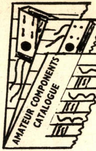

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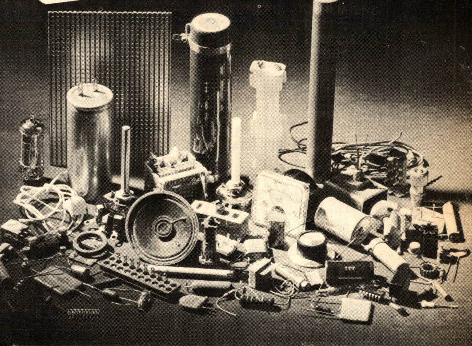

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CAPACITORS	FOIL																CERAMIC						
	MICA				POLY CARBONATE				POLY STYRENE				POLYESTER				DISC/PLATE				FEED-THROUGH		
	Less than 10pF	10pF to 1000pF	Above 1000pF	5% or better	Less than 10pF	10pF to 1000pF	Above 1000pF	5% or better	Less than 10pF	10pF to 1000pF	Above 1000pF	5% or better	Less than 10pF	10pF to 1000pF	Above 1000pF	5% or better	Less than 10pF	10pF to 1000pF	Above 1000pF	5% or better	Less than 10pF	10pF to 1000pF	Above 1000pF
A1 Radio	◆	◆	◆		◆	◆	◆		◆	◆	◆		◆	◆	◆		◆	◆	◆	◆			
Amateur Comps										◆	◆				◆								
Ambit								◆		◆	◆	◆						◆	◆			◆	
Anco										◆	◆			◆	◆			◆	◆				
Astro Electronics	◆	◆	◆				◆			◆	◆				◆			◆					
Bamber						◆	◆		◆	◆	◆			◆	◆			◆	◆				
Bi-Pak																	◆	◆	◆				
Birkett	◆	◆	◆						◆	◆	◆						◆	◆	◆		◆	◆	
Bull	◆	◆	◆		◆	◆	◆		◆	◆	◆		◆	◆	◆		◆	◆	◆				
Catronics																						◆	
Chromasonic	◆	◆		◆		◆	◆		◆	◆	◆	◆			◆	◆	◆	◆	◆	◆			
Crofton																					◆	◆	◆
C.W. Electronics													◆	◆	◆		◆	◆	◆				
Denco										◆													
Doram	◆	◆	◆	◆						◆	◆	◆		◆	◆		◆	◆	◆	◆			
Electronic Equipment										◆	◆	◆	◆	◆	◆		◆	◆	◆				
Electro-Tech	◆	◆	◆		◆	◆	◆		◆	◆	◆	◆	◆	◆	◆		◆	◆	◆			◆	
Electrovalue	◆	◆	◆	◆					◆	◆	◆	◆			◆	◆	◆	◆	◆	◆		◆	
Greenwood		◆	◆				◆			◆	◆	◆			◆		◆	◆	◆			◆	
H.B. Electronics							◆	◆									◆	◆	◆	◆			
Home Radio	◆	◆	◆	◆						◆	◆	◆			◆		◆	◆	◆				◆
L.B. Electronics					◆	◆	◆											◆					
Lektropaks	◆	◆	◆			◆	◆		◆	◆	◆			◆	◆		◆	◆	◆				
Lynx																							
Maplin	◆	◆	◆	◆			◆	◆		◆		◆			◆		◆	◆	◆	◆		◆	
Marshall		◆		◆			◆	◆		◆	◆	◆			◆	◆	◆	◆	◆	◆		◆	
Orchard															◆		◆	◆	◆				
Osmabet																							
P.B. Electronics					◆	◆	◆	◆									◆	◆	◆	◆			
P.H.D. Components	◆	◆	◆	◆					◆	◆	◆	◆		◆	◆		◆	◆	◆				
Pinnacle																							
Quality Electronics																							
Radio Components	◆	◆	◆	◆		◆	◆		◆	◆	◆			◆	◆		◆	◆	◆	◆			
Radio Shack	◆	◆	◆	◆	◆	◆	◆	◆				◆	◆	◆	◆	◆	◆	◆	◆	◆			
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Salop Electronics	◆	◆												◆	◆			◆	◆				
Stevenson															◆								
Teleradio	◆	◆					◆	◆	◆	◆	◆				◆		◆	◆	◆				
T.K. Electronics														◆	◆								
Watford Electronics	◆	◆	◆	◆			◆		◆	◆	◆	◆			◆		◆	◆	◆			◆	
West Hyde Dev									◆	◆	◆	◆											
Xeroza										◆					◆		◆	◆	◆				
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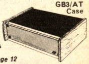

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RESISTORS	Carbon												Metal Film/Oxide										
	Below ¼W			¼W to 1W			1W to 10W			Above 10W			Below ¼W		¼W to 1W			1W to 10W			Above 10W		
	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ
A1 Radio		◆	◆		◆	◆		◆	◆					◆									
Amateur Comps															◆	◆	◆						
Ambit				◆	◆	◆																	
Anco				◆	◆	◆	◆																
Astro Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆						◆	◆	◆						
Barrie				◆	◆	◆							◆	◆		◆	◆		◆				
Bi-Pak					◆	◆																	
Birkett	◆	◆		◆	◆	◆	◆	◆	◆														
Bull	◆	◆	◆																				
Catronics																							
Chromasonic				◆	◆	◆	◆	◆							◆	◆							
C.W. Electronics				◆	◆	◆		◆								◆							
Doram					◆											◆	◆						
Electronic Equipment				◆	◆	◆		◆								◆							
Electro-Tech															◆	◆	◆						
Electrovalue		◆		◆	◆	◆									◆	◆							
Greenwood				◆	◆	◆									◆	◆	◆						
H.B. Electronics				◆	◆	◆									◆	◆							
Home Radio					◆			◆		◆	◆				◆	◆	◆		◆				
L.B. Electronics																							
Lektropaks					◆	◆										◆							
Lynx					◆	◆																	
Maplin				◆	◆	◆										◆							
Marshall					◆	◆	◆	◆	◆						◆	◆	◆						
Orchard				◆	◆	◆																	
P.B. Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆											
P.H.D. Components					◆	◆		◆	◆									◆	◆				
Pinnacle																		◆	◆	◆	◆	◆	◆
Quality Electronics																							
Radio Components				◆	◆	◆	◆	◆	◆							◆							
Radio Shack	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Ramar				◆	◆	◆																	
R.B. Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆				◆	◆	◆	◆		◆					
Salop Electronics				◆	◆	◆																	
Stevenson C.N.				◆	◆																		
Teleradio	◆	◆	◆	◆	◆	◆							◆		◆	◆	◆						
T.K. Electronics					◆	◆																	
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Xeroza				◆	◆	◆																	
Z & I				◆	◆	◆												◆	◆	◆			
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FOR ALL YOUR VALVES, TUBES AND SEMICONDUCTOR REQUIREMENTS

Directory entry on pages: 6, 10, 14

SCIENTIFIC WIRE CO.
P.O. BOX 30

Specialists in Instrument and Resistance Wire

CHINGFORD, LONDON E4

See Directory entry

C. W. ELECTRONICS COMPONENTS
FOR

RESISTORS, CAPAC., TRANS., DIODES, POTS., L.E.D.'s, etc. SAE for more details. Dept PWS, No. 10, Kingsley Path, Britwell Estate, Slough, Berks., SL2 2NS.

Phone Slough 26422 (0130-1700). Trade, Retail and Export.

Directory entry on pages: 2, 4, 6, 8, 10, 12

CROFTON
ELECTRONICS LIMITED
35 Grosvenor Road, Twickenham, Middx
Tel: 01·891 1923
Specialist Suppliers of
VDU/MACRO COMPUTER PARTS
T.V. CAMERAS & MODULATORS

Directory entry on pages 2, 12

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SHORT FORM
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Free

CHROMASONIC
ELECTRONICS

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London N10

Directory entry on pages: 2, 4, 6, 8, 10, 12

J. BULL (ELECTRICAL) LTD.
103 Tamworth Road

TRY US FIRST
FOR ALL SPARES

CROYDON

Directory entry on pages: 2, 4, 6, 8, 10, 12

Wire wound										Cermet			Special Purpose							Variable							Slider		Preset						
Below ⅛W		⅛W to 1W		1W to 10W			Above 10W			⅛W to 1W										Single turn															
Less than 10Ω	10Ω to 1MΩ	Less than 10Ω	10Ω to 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Less than 10Ω	10Ω to 1MΩ	Above 1MΩ	Cermet	H.F.	Semiconductor	Temp. dependent	Volt. dependent	Light dependent	1% or better	Decade box	Carbon	Moulded	Wirewound	Ganged	With switch	Ganged with switch	Single	Ganged	Cermet	Moulded	Wire wound	With knob			
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SEMICONDUCTORS DISPLAYS VALVES	Diodes											Transistors												
	Silicon							Germanium			Other	Silicon							Germanium					
	Signal	Rectifier	Zener	Light-emitting	Varactor	Tunnel	Rect. assemblies	Signal	Rectifier	Zener	Light-emitting	R.F.	U.H.F.	Switching	Power	High voltage	Unijunction	Opto	R.F.	U.H.F.	Switching	Power	High voltage	Unijunction
A1 Radio	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆		◆		◆	◆	◆	◆
Amateur Comps	◆	◆					◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Ambit	◆	◆			◆			◆				◆	◆	◆	◆		◆							
Anco	◆	◆	◆	◆			◆	◆				◆	◆	◆	◆	◆	◆	◆	◆		◆	◆		
Astro Electronics	◆	◆	◆	◆			◆	◆		◆	◆	◆		◆	◆	◆	◆	◆	◆		◆	◆	◆	◆
Bamber	◆	◆	◆		◆			◆				◆	◆	◆		◆								
Barrie	◆	◆	◆					◆	◆			◆		◆	◆	◆	◆	◆	◆		◆	◆		
Bi-Pak	◆	◆	◆	◆	◆		◆	◆				◆	◆	◆	◆	◆	◆	◆	◆		◆	◆		
Birkett	◆	◆	◆	◆	◆	◆	◆	◆	◆			◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		
Bull		◆	◆	◆				◆				◆							◆			◆		
Catronics	◆	◆	◆	◆	◆		◆	◆				◆	◆	◆	◆							◆		
Chromasonic	◆	◆	◆	◆	◆		◆	◆				◆	◆	◆	◆	◆	◆	◆	◆		◆	◆		
Cox Radio																								
C.W. Electronics	◆	◆	◆	◆				◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Doram	◆	◆	◆	◆			◆	◆			◆	◆	◆	◆	◆	◆	◆		◆		◆	◆		
Electronic Equipment	◆	◆	◆					◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Electro-Tech	◆	◆	◆	◆			◆	◆	◆			◆	◆	◆	◆	◆	◆							
Electrovalue	◆	◆	◆		◆		◆	◆			◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	
Greenbank	◆	◆												◆										
Greenwood	◆	◆	◆	◆	◆		◆	◆	◆			◆		◆	◆	◆	◆		◆	◆	◆	◆		
Harmsworth		◆	◆				◆							◆	◆	◆								
H.B. Electronics	◆	◆	◆		◆		◆	◆			◆	◆	◆	◆	◆	◆	◆		◆		◆	◆		
Home Radio	◆	◆	◆	◆				◆	◆	◆		◆	◆	◆	◆			◆	◆	◆	◆	◆		
L.B. Electronics	◆		◆				◆				◆	◆		◆				◆						
Lektropaks	◆	◆	◆	◆			◆	◆				◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Lynx	◆	◆	◆	◆				◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Maplin	◆	◆	◆	◆			◆	◆				◆	◆	◆	◆	◆	◆	◆	◆		◆	◆		
Marshall	◆	◆	◆			◆	◆	◆	◆		◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆		◆
Orchard	◆	◆	◆	◆			◆	◆				◆	◆	◆	◆	◆	◆		◆		◆	◆	◆	
P.H.D. Components	◆	◆	◆		◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆
Pinnacle	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆						
Radio Components	◆	◆	◆	◆				◆	◆			◆		◆	◆	◆	◆		◆	◆	◆	◆	◆	◆
Radio Shack	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	
R.B. Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
R.S.T. Valve	◆	◆	◆		◆		◆	◆	◆	◆		◆	◆	◆	◆	◆			◆	◆	◆	◆		
Salop Electronics	◆	◆	◆	◆			◆	◆				◆			◆				◆			◆		
Stevenson	◆	◆	◆	◆				◆	◆			◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆
Technomatic	◆	◆	◆	◆				◆				◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		
Teleradio	◆	◆	◆	◆				◆	◆	◆		◆		◆	◆		◆		◆					
T.K. Electronics	◆	◆		◆										◆	◆		◆							
Watford Electronics	◆	◆	◆	◆	◆	◆	◆					◆		◆	◆		◆	◆	◆	◆				
West Hyde Dev	◆													◆										
Xeroza	◆	◆	◆	◆	◆	◆		◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
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SOUTHERN

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for

Transistors, I.Cs, Capacitors, Resistors and electronic components, S.A.E. will bring list of 200 kits for home construction.

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Directory entry on page 6

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Directory entry on page 14

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Glasgow G2 2QD
Tel: 041-332 4133

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Directory entry on page 12

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Directory entry on page 12

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Quality Electronics
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Kent TN29 9AJ
0679 20252
Pay: CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

Quartz Crystal Co
QCC Works, Wellington Crescent, New Malden,
Surrey KT3 3NQ
01-942 2988/0334
Cat: 13p (stamps). **Pay:** CWO **OB** Post **VE C** 20p on orders under £10

Radio Components Specialists
337 Whitehorse Road,
Croydon
01-684 1665
Cat: 10p. **Pay:** CWO Ch Cash **OB** Phone Post Call **VI CE**

P. F. Ralfe Electronics
10 Chapel Street,
London NW1
01-723 8753
Pay: CWO Ch Cash Acc **OB** Post Call **VE CE**

Ramar Constructor Services
Masons Road, Stratford On Avon, Warwicks
0789 4879
Cat: 15p. **Pay:** CWO Ch Cash **OB** Phone Post Call **VI CE**

R.B. Electronics
24 Springfield Park,
Holyport, Maidenhead,
Berks
0628 39798
Cat: free. **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VI C** 15p on orders under £2

R.S.P. Electronics
53 Barton Street
Gloucester
0452 23607
Pay: CWO **OB** Phone Post Call **VE CE**

RST Valve Mail Order Co.
Climax House, Fallsbrook Road, Streatham,
London SW16 6ED
Cat: free. **Pay:** CWO Ch Cash **OB** Post Call **VE CE**

Salop Electronics
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Salop
0743 53206
MOC 75p **Pay:** CWO Ch Cash **OB** Phone Post Call **VI CE**

Sandwell Plant
201 Monmouth Drive,
Sutton Coldfield, West Midlands B73 6JS
021-354 9764
Cat: 75p. **Pay:** CWO Ch Cash **OB** Post **VI CE**

E. A. Sowter
Dedham Place, Ipswich
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0473 52794
Pay: CWO COD Ch Cash **OB** Phone Post **VE CE**

S.S.T. Distributors
West Road, Tottenham,
London N17 0RN
01-808 4884
Cat: free. **Pay:** CWO COD Ch Cash **OB** Phone Post **VI CI**

C. N. Stevenson
304 Avery Hill Road,
London SE9 2JN
01-850 8475
Cat: free. **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VI C** 20p

Stirling Sound
222 West Road,
Westcliff-on-Sea, Essex
Pay: CWO Ch Cash **OB** Phone Post Call (Mail orders to 37 Vanguard Way, Shoeburyness, Essex) **Cat:** free. **VI CI**

Technomatic
54 Sandhurst Road,
London NW9
01-204 4333
Cat: free. **Pay:** Ch Cash Acc **OB** Post **VI CI**

Teleradio Co (Edmonton)
325 Fore Street,
London N9 0PE
Cat: SAE **MOC** £1 **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VE CE**

Television Tube Shop
52 Battersea Bridge Road,
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01-228 6859
Cat: free. **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VE CE**

Tidman Mail Order
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Richmond, Surrey
TW9 2EQ
01-948 3702
Pay: CWO Ch Cash **OB** Post Call **VI CI**

TK Electronics
106 Studley Grange Road,
London W7 2LX
Cat: free. **Pay:** CWO Ch Cash Acc **OB** Post **VE CE**

Vero Electronics
Industrial Estate,
Chandlers Ford, Eastleigh,
Hants SO5 3ZR
04215 2956
Cat: Free. **Pay:** CWO, COD Acc **OB** Phone Post **VE CE**

Watford Electronics
33 Cardiff Road, Watford,
Herts
92 37774
Cat: (available Dec 77). **Pay:** CWO Ch Cash Acc **OB** Post Call **VE C** 25p on orders under £10

West Hyde Development
Ryefield Crescent,
Northwood, Middx
HA6 1NN
65 24941/26732
Cat: Free. **MOC** £2 **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VE CI**

Wilmslow Audio
Swan Works, Bank Square, Wilmslow,
Cheshire
09964 29599
Cat: 15p. **Pay:** CWO Ch Cash **OB** Phone Post Call **VI CE**

Z&I Aero Services
42 Westbourne Grove,
London W2 5SF
01-727 5641
Cat: 30p. **MOC** £10 **Pay:** CWO Ch Cash **OB** Post Call **VE CE**

Acc	Account by arrangement
C	Carriage
Call	Personal callers
Cat	Catalogue or brochure
CE	Carriage extra
Ch	Cheque
CI	Carriage included
COD	Cash on delivery, with possible surcharge
CWO	Cash with order
MOC	Minimum order charge
OB	Order by . . .
Pay	Method of payment
V	VAT
VE	VAT extra
VI	VAT included

	Multi-layer Devices			Integrated Circuits													Displays											Valves							
				Digital					Analogue				LSI				Single Digit						Multi-Digit												
Opto	Diac	Triac	SCR	TTL	ECL	D to A	DTL	MOS	Audio	R.F.	Op.Amp	A to D	Clock	Radio	T.V. Games	Others	LED	LCD	Phosphor	Cold cathode	Filament	CRT	Led	LCD	Phosphor	Cold cathode	CRT	Cold cathode	EHT rectifier	Photo-electric	Receiving	Transmitting	T.V.	Obsolete	
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WOUND COMPONETS FERRITES FILTERS WIRE & CABLES

	Mains Transformers						Other Transformers									Coils								
	Low voltage	High voltage	Isolating	Variable	Constant voltage	Auto-wound	R.F.	I.F.	Audio driver	Inter-stage	Speaker	Microphone	Pulse	T.V.	Heater	R.F.	Amp. mod.	Freq. mod.	T.V.	Reed relay	Low frequency	High frequency	Variable	Formers
A1 Radio	◆	◆	◆	◆	◆	◆			◆		◆		◆											
Ambit	◆						◆	◆					◆	◆		◆	◆	◆	◆		◆	◆	◆	◆
Anco	◆																							◆
Astro Electronics	◆	◆	◆	◆		◆	◆	◆					◆			◆		◆	◆		◆	◆		◆
Bamber	◆	◆	◆		◆	◆	◆									◆								
Barrie	◆	◆	◆	◆	◆	◆					◆													
Bi-Pak	◆								◆	◆	◆											◆		
Birkett	◆	◆	◆			◆	◆	◆	◆	◆	◆		◆			◆	◆	◆	◆	◆	◆	◆		◆
Bull	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆		◆		◆									
Scientific Wire																								
Catronics	◆						◆	◆								◆			◆					◆
Chromasonic	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆					◆	◆	◆	◆		◆	◆	◆	◆	
Copper Supplies																								
C.W. Electronics	◆	◆							◆			◆			◆					◆				◆
Denco							◆	◆								◆	◆	◆			◆	◆	◆	◆
Doram	◆		◆			◆						◆	◆									◆		◆
Drake	◆	◆	◆			◆			◆	◆	◆	◆	◆		◆		◆				◆	◆		
Eagle	◆			◆	◆							◆												
Electronic Equipment	◆		◆		◆									◆										
Electro-Tech	◆	◆	◆	◆		◆																		
Electrovalue	◆																			◆		◆		◆
Greenbank	◆																							
Greenwood	◆										◆	◆								◆				◆
H.B. Electronics	◆	◆					◆	◆					◆			◆	◆	◆		◆	◆	◆	◆	◆
Home Radio	◆							◆	◆	◆		◆			◆	◆		◆		◆	◆	◆		◆
Interface Quartz																								
L.B. Electronics	◆							◆			◆													
Lektropaks	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆			◆	◆									
Maplin	◆	◆					◆	◆	◆	◆	◆	◆	◆			◆	◆	◆		◆	◆	◆	◆	◆
Marshall	◆																			◆				
Orchard	◆								◆															
Osmabet	◆	◆	◆			◆					◆				◆									
P.H.D. Electronics																								
Radio Components	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆						◆	◆		◆
Radio Shack	◆	◆							◆	◆	◆		◆			◆	◆	◆	◆	◆	◆	◆		◆
R.B. Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		
Salop Electronics	◆	◆	◆						◆		◆				◆	◆						◆		◆
Sowter											◆	◆												
Teleradio	◆		◆					◆	◆	◆						◆				◆		◆		◆
Tidman																			◆					
T.K. Electronics	◆																					◆		
Watford Electronics	◆						◆	◆	◆				◆			◆	◆				◆	◆		◆
West Hyde Dev	◆																							
Xeroza																								

Pay: CWO Ch Cash Acc **OB** Phone Post Call **MOC** £10 **VE**

Electronic-Kit
20 Bride Lane, Ludgate Circus, London EC4 8DX
01-353 6430
Cat: 11p. **Pay:** CWO Ch Cash **OB** Post Call **VI CI**

Electrovalue
28 St Judes Road, Englefield Green, Egham, Surrey TW0 0HB
01 389 3603
Cat: 50p. **Pay:** CWO Ch Cash **OB** Phone Post Call **MOC** 25p on orders less than £5 **VE CI**

Flight Link Control
Bristow Works, Bristow Road, Hounslow, Middx
01-570 4065
Cat: free. **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VE CE**

Greenbank Electronics
94 New Chester Road, New Ferry, Wirral L62 5AG
051-645 3391
Cat: free. **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

Greenweld Electronics
443 Millbrook Road, Southampton SO1 0HX
0703 772501
Cat: 30p + 15p p&p. **Pay:** CWO COD Ch Cash Acc **OB** Post Call **VI CI MOC** £1

G2DYM Aerials
Lambda Antenna Stud Farm, Whiteball, Wellington, Somerset
Greenham 672247
Cat: 18p + large SAE (12½p). **Pay:** CWO Ch Cash **OB** Post **VE CE**

Adam Hall
Unit 'Q' Starline Works, Grainger Road, Southend-on-Sea, Essex
0702 613292
Cat: SAE. **MOC** £4 **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VE CI**

Harmsworth, Townley & Co.
Harehill, Todmorden, Lancs OL14 5EF
070 681 2601

Pay: CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

Hart Electronics
Penylan Mill, Oswestry, Shropshire
0691 2894
Cat: free. **Pay:** CWO Ch Cash **OB** Phone Post Call **VE CI**

H.B. Electronics
22 Newland Street, Kettering, Northants
0536 83922
Pay: CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

Home Radio
240 London Road, Mitcham, Surrey CR4 3HD
01-648 8422
Cat: £1. **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VE CE**

H.M. Electronics
275a Fulwood Road, Broomhill, Sheffield S10 3BD
0742 669676
Cat: 15p. **Pay:** CWO COD Ch Cash **OB** Phone Post Call **VE CE**

Interface Quartz Devices
29 Market Street, Crewkerne, Somerset TA18 7JU
0460 74433
Pay: CWO Ch Cash Acc **OB** Phone Post Call **VE CI**

Lektropaks
17 Turnham Green Terrace, Chiswick W4
Pay: CWO COD Ch Cash **OB** Post Call **VE CE**

Lynx Electronics (London)
92 Broad Street, Chesham, Bucks
02405 75154
Cat: 20p. **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VE CE** (30p for 1st class post)

Maplin Electronic Supplies
284 London Road, Westcliff-on-Sea, Essex
Cat: 60p. **Pay:** CWO Ch Cash **OB** Call at above address or post to PO

Box 3 Rayleigh, Essex
VI CI

A. Marshall (London)
42 Cricklewood Broadway, London NW2 3E7
01-452 0161
Cat: 25p callers, 35p post. **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VE CE**

McKnight Crystal Co.
Hardley Industrial Estate, Hythe, Southampton SO4 6ZY
0703 848961
MOC £6 + VAT **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VI CE**

Orchard Electronics
Flint House, High Street, Wallingford, Oxon
0491 35529
Cat: 50p. **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

Osmabet
46 Kenilworth Road, Edgware, Middx HA8 8YG
01-958 9314
Cat: free. **Pay:** CWO Ch Cash Acc **OB** Post **VE CE**

P.B. Electronics
57 High Street, Saffron Waldon, Essex CB10 1AA
0799 22876
Cat: free. **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

P.H.D. Components
Dept 3 Unit 7, Centenary Estate, Jeffreys Road, Enfield, Middx
Cat: 25p. **Pay:** CWO Ch Cash **OB** Post **VI CE**

Pinnacle Electronics
Electron House, Cray Avenue, St Mary Cray, Kent BR5 3QI
66 71531
Cat: free. **MOC** £5 **Pay:** CWO COD Ch Cash Acc **OB** Phone Post **VE CE**

P.K.G. Electronics
Oak Lodge, Church Street, Tansley, Derbyshire DE4 5FE
0629 3206
Cat: free. **Pay:** CWO **OB** Post **VI CE**

Proto Design
4 Highcliffe Way, Wickford, Essex
03744 62994

Directory of Suppliers

AD Electronics
217 Warbreck Moor,
Aintree, Liverpool L9 0HU
051 525 3440
Cat: Free. **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

AEL Crystals
Gatwick House, Horley,
Surrey RH6 9SU
Horley 5353
Cat: fee. **Pay:** CWO Ch Cash Acc **OB** Phone Post **VE CE**

Ambit International
37a High St, Brentwood,
Essex CM14 4RH
0277 216029
Cat: 40p. **Pay:** CWO COD Cash **MOC** £1 **VE CE OB** Phone Post Call

Amateur Components
128 Carshalton Rd,
Sutton, Surrey
01-647 1006
Cat: free. **Pay:** CWO Ch Cash **MOC £2 OB** Post **VE CE**

Anco Distribution
48 Rainsford Rd,
Chelmsford, Essex
0245 56805
Cat: 25p. **Pay:** CWO Ch Cash Acc **OB** Phone Post Call **VI CE**

Astro Electronics
Springbank Rd,
Chesterfield, Derbyshire
0246 31475
Pay: CWO COD Ch Cash **OB** Phone Post Call **VE CE**

Baron
Southview House,
6 Gower Road, Royston,
Herts
0763 43695
Pay: CWO Ch Cash **MOC** £3 **OB** Phone Post **VI CI**

Bazelli
St Wilfrids, Foundry Lane,
Halton, Lancs LA2 6LT
Cat: free. **Pay:** Ch Cash Acc **OB** Post Call **VE CE**

Bi-Pak
63a High Street, Ware,
Herts
0920 3442
Cat: 50p + 15p p&p **Pay:** CWO Ch Cash **OB** Post Call

Birkett
25 The Strait, Lincoln
LN2 1JF
0522 20767
Cat: free. **Pay:** CWO Ch Cash **OB** Phone Post Call **VI CE**

Boss Industrial Mouldings
Higgs Industrial Estate,
2 Herne Hill Road,
London SE24 0AU
01-737 2383
Cat: free. **Pay:** CWO Ch Cash Acc **MOC** £2·50 **OB** Phone Post Call **VE CE**

Bywood Electronics
68 Ebberns Road, Hemel
Hempstead, HP3 9QRW
0442 62757
Cat: SAE. **Pay:** CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE** 30p

Cambridge Kits
45(P) Old School Lane,
Milton, Cambs CB4 4BS
0223 860150
Cat: free. **Pay:** CWO Ch Cash **OB** Post **VI CI**

Cambridge Learning Enterprises
Rivermill Lodge, St Ives,
Huntingdon PE17 4BR
0480 67446
Cat: free. **Pay:** CWO Ch Cash Acc **OB** Post **V** Zero rated **CI**

Catronics
Communications House,
20 Wallington Square,
Wallington, Surrey
01-669 6700
Cat: 35p + 15p p&p. **Pay:** CWO Ch Cash Acc **OB** Phone Call **VI CE** (20p min)

Chromasonic Electronics
56 Fortis Green Road,
Muswell Hill,
London N10 3HN
Cat: SAE. **Pay:** CWO Ch Cash Acc **OB** Post Call **VI CE**

Copper Supplies
102 Parrswood Road,
Withington, Manchester 20
061-445 8753
Pay CWO Acc **OB** Post **VI CE**

Cox Radio (Sussex)
The Parade, East
Wittering, Sussex
024366 2023
Cat: 20p. **Pay:** CWO COD Ch Cash **OB** Phone Post Call **VI CI**

C.W. Electronics
10 Kingsley Path, Britwell
Estate, Slough, Berks
Slough 26422
Pay: CWO, COD, Ch, Cash Acc **OB** Post Call **MOC £2 VE CE**

Decon Laboratories
Ellen Street, Portslade,
Brighton BN4 1EQ
0273 414371
Cat: free. **MOC £5 Pay:** CWO Ch Cash **OB** Phone Post Call **VI CI**

Denco (Clacton)
355 Old Road,
Clacton-on-Sea 0255 22807
Cat: 34p. **Pay:** CWO Ch Cash **OB** Phone Post Call **VE CE**

Doram
PO Box TR8, Wellington
Road Ind. Estate,
Wellington Bridge,
Leeds LS12 2UF
Wellington Bridge 34222
Cat: 20p p&p. **Pay:** CWO Ch Cash **OB** Post **MOC** 40p extra on orders less than £2 **VI CE**

Drake Transformers
Kennel Lane, Billericay,
Essex CM11 2RL
02774 51155
Cat: SAE. **Pay:** CWO Acc **OB** Post **MOC** varies **VE CE**

Eagle International
Heather Park Drive,
Wembley, Middx HA0 1SU
01-902 8832
Cat. free. Distribution by wholesale or dealer. Nearest supplier given by Head Office

Electronic Brokers
49 Pancras Road, London
NW1 2QB
01-837 7781
Cat: 50p. **Pay:** CWO Ch Cash **OB** Post Call **VE CE**

Electronic Equipment
Springfield House,
Tyssen Street, London E8
01-249 5217

Inductors												Ferrites						Filters						Wire & Cables											
Below 1µH						Above 1µH												Fixed Frequency				Variable													
Miniature	Toroidal	Moulded	H.F.	L.F.	Variable	Miniature	Toroidal	Moulded	H.F.	L.F.	Variable	Inductor core	Transformer core	Pot core	Rod	Slab	Beads	Ceramic	Inductive	Capacitive	Crystal	Inductive	Capacitive	Enamelled	Tinned copper	Resistance	Litz	Single core	Multi-core	Coax	Other screened	E.H.T.	Mains	P.V.C.	Glass
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RELAYS CONNECTORS TERMINALS SWITCHES HOLDERS

	Relays												Connectors											
	Chassis Mtg	Contactor	Crystal can	DIL	Mercury wetted	Miniature	Plug-in	PCB Mtg	Reed	Solid state	Time delay	TO5 can	Audio	Radio	Flat cable	Jack	Mains	Multipin	PCB	Rack & panel	Coax	EHT	Valve top-cap	Battery
A.I. Radio	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆
A.D. Electronics	◆			◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆			◆
Amateur Comps																								◆
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Anco						◆	◆		◆				◆	◆		◆	◆		◆		◆			◆
Astro Electronics	◆			◆		◆	◆	◆	◆	◆			◆	◆		◆	◆	◆	◆	◆	◆			◆
Bamber				◆		◆	◆						◆	◆		◆	◆				◆			
Barrie													◆	◆		◆	◆				◆			◆
Bi-Pak													◆	◆		◆	◆				◆			◆
Birkett	◆												◆	◆	◆	◆	◆	◆			◆			◆
Bull	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Bywood															◆				◆	◆				
Catronics								◆	◆					◆		◆			◆		◆			
Chromasonic	◆			◆		◆	◆	◆	◆	◆			◆	◆		◆		◆			◆			◆
C.W. Electronics						◆	◆	◆					◆	◆		◆	◆	◆			◆			◆
Doram	◆			◆		◆	◆	◆	◆				◆	◆	◆	◆	◆	◆	◆		◆			◆
Eagle													◆			◆								◆
Electronic Equipment	◆					◆	◆	◆	◆		◆		◆	◆		◆	◆	◆						
Electro-Tech	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
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Greenwood	◆			◆		◆	◆		◆		◆		◆	◆		◆	◆	◆	◆		◆			◆
H.B. Electronics	◆			◆		◆	◆	◆	◆				◆	◆	◆	◆	◆	◆	◆	◆	◆			◆
Home Radio						◆	◆		◆				◆	◆	◆	◆	◆	◆			◆	◆	◆	
Interface Quartz																								
L.B. Electronics				◆		◆	◆									◆			◆					
Lektropaks	◆	◆		◆	◆	◆	◆	◆	◆				◆	◆	◆	◆	◆	◆	◆		◆			◆
Maplin	◆			◆		◆	◆	◆	◆				◆	◆	◆	◆	◆	◆	◆		◆			◆
Marshall				◆	◆	◆							◆	◆		◆				◆	◆			◆
Orchard						◆							◆	◆	◆	◆	◆	◆						◆
Pinnacle	◆	◆				◆	◆	◆	◆	◆	◆							◆	◆	◆	◆			
Quality Electronics	◆					◆												◆	◆		◆			
Radio Components	◆					◆	◆						◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆
Radio Shack	◆	◆		◆	◆	◆	◆	◆	◆	◆			◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆
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R.S.P. Electronics													◆	◆	◆	◆	◆				◆			
R.S.T. Valve																								
Salop Electronics	◆					◆							◆	◆		◆	◆	◆			◆			◆
Sandwell																								
Teleradio	◆					◆	◆		◆				◆	◆			◆				◆			◆
T.K. Electronics																								
Watford Electronics						◆			◆				◆	◆	◆	◆	◆	◆	◆	◆	◆			◆
Xeroza						◆	◆																	
P.K.G. Electronics																								

	Heatsinks				Knobs						Meters					Opto-Electronics				Speakers						Test Equipment				Miscellaneous					
Couplers	Discrete device	IC types	Power	Heat conducting paste	Collet	Plain	Skirted	Winged	Pointer	Slider	Panel	Edge	Multi	Frequency	Megger type	Opto-isolators	Infra-red	7 segment	Matrix	Ear	Miniature	High power	Cabinets	Complete	Piezo-electric	Oscilloscope	Signal Generator	Counter/Timer	Bridge	Aerials	Books /Courses	Breadboards/kits	Solar Batteries	Stand-offs	Dry Transfers
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Electro-Tech
315 Edgware Road,
London W2
01-723 5667 & 01-402 5580
Pay: CWO Ch Cash
Acc **OB** Phone Post Call
VI CE

L.B. Electronics
43 Westacott, Hayes,
Middx UB4 8AH
Cat: free. **Pay:** CWO Ch
Cash Acc **OB** Post **V**
Zero rated **CI**

Manor Supplies
172 West End Lane,
London NW6 19D
01-794 8751
Cat: free. **Pay:** CWO
COD Ch Cash **OB** Phone
Post Call **VE CE**

Monolithic Electronic Co.
5 Church Street,
Crewkerne, Somerset
0460 74321
Cat: 15p **Pay:** CWO Ch
Cash Acc **OB** Post Call
VI CE

The Radio Shack
161 St Johns Hill,
Battersea, London SW11
MOC £1 Pay: CWO Ch
Cash **OB** Post Call **VE**
CE

Xeroza Radio
306 St Paul's Road,
Highbury Corner, London
N.1
01-226 1489
Pay: CWO Ch Cash Acc
OB Post **VI CI**

BOARDS PANELS CHASSIS CASES & BOXES KNOBS HARDWARE HEATSINKS MISCELLANEOUS

	Boards						Cases & Boxes					Chassis						Crystals		Dials-Drives			Hard ware	
	Paper/Glass Fibre																							
	Plain	Drilled	Copper strip	DIL patterned	Copper clad	Etched	Metal, plain	Metal, plastic covered	Diecast	Plastic	Handles	Plain	Drilled	Folded	Printed	Kits	Sheet	Standard ranges	Ground to order	Tuning (direct)	Tuning (slow motion)	Digital indicating	Nuts Bolts Screws	Screwed rod
Maplin	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆						◆			◆		◆	◆
Marshall	◆	◆		◆	◆		◆	◆	◆	◆								◆						
McKnight Crystal																		◆	◆					
Orchard		◆	◆	◆	◆		◆	◆	◆	◆														
Osmabet																								
P.B. Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆						◆								
P.H.D. Electronics																		◆						
Pinnacle																				◆		◆		
Proto Design	◆	◆				◆																		
Quality Electronics																								
Quartz Crystal																		◆	◆					
Radio Components	◆	◆	◆		◆	◆	◆	◆		◆	◆	◆				◆				◆	◆		◆	
Radio Shack	◆	◆	◆	◆	◆	◆	◆			◆	◆	◆									◆			
Ramar	◆				◆	◆																	◆	◆
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R.B. Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆		◆	◆		◆	◆
R.S.P. Electronics							◆														◆			
R.S.T. Valve																								
Salop Electronics	◆	◆	◆		◆						◆	◆					◆							
P.K.G. Electronics																								
S.S.T. Dist			◆							◆						◆								
Stevenson																								
Stirling Sound																								
Teleradio		◆				◆	◆	◆		◆		◆	◆	◆	◆	◆		◆						
T.K. Electronics																								
Vero	◆	◆	◆	◆	◆		◆	◆		◆		◆												
Watford Electronics	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆			◆	◆	◆	◆		◆	
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Xeroza					◆					◆														
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Directory of Suppliers

(Late entries)

A.1 Radio Components
19 The Borough,
Canterbury, Kent CT1 2DR
0221 68136
Pay: CWO COD Ch Cash **OB** Phone Post Call **VE CE**

Bamber Electronics
5 Station Road, Littleport,
Cambs CB6 1QE
0353 860185
Cat: SAE. **MOC** £2
Pay: CWO Ch Cash **OB** Post Call **VE CI**

Barrie Electronics
3 The Minories, London
EC3N 18J
01-488 3316
Cat: Free. **Pay:** CWO COD Ch Cash **OB** Phone Post Call **VE CE**

J. Bull (Electrical)
102 Tamworth Road,
Croydon, Surrey
01-688 1833
Cat: free. **MOC** 60p if order under £6 **Pay:** CWO **OB** Phone Post Call **VE CI**

Crofton Electronics
35 Grosvenor Road,
Twickenham, Middx
01-891 1923
Cat: free. **MOC** 50p
Pay: CWO COD Ch Cash Acc **OB** Phone Post Call **VE CE**

Denco (Clacton)
355 Old Road,
Clacton-on-Sea
0255 22807
Cat: 34p. **Pay:** CWO Ch Cash **OB** Phone Post Call **VE CE**

Terminals								Switches																				Holders						
DIN	Block	Strip	Tag-strip	Tagboard	Tags	Board pins	Croc. clips	DIL	Keyboard	Key	Lever	Micro	PCB	Button	Push-pull	Push-push	Proximity	Rocker	Rotary kits	Rotary assembled	Reed	Thermal	Thumbwheel	Toggle	Touch	Opto	Interlocked	Valve	CRT	Integrated cct	Transistor	Battery	Crystal	PCB
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BOARDS
PANELS
CHASSIS
CASES & BOXES
KNOBS
HARDWARE
HEATSINKS
MISCELLANEOUS

	Boards Paper/Glass Fibre						Cases & Boxes					Chassis						Crystals		Dials-Drives			Hardware	
	Plain	Drilled	Copper strip	DIL patterned	Copper clad	Etched	Metal, plain	Metal, plastic covered	Diecast	Plastic	Handles	Plain	Drilled	Folded	Printed	Kits	Sheet	Standard ranges	Ground to order	Tuning (direct)	Tuning (slow motion)	Digital indicating	Nuts/Bolts/Screws	Screwed rod
A1 Radio	◆	◆	◆		◆		◆		◆	◆								◆					◆	◆
A.D. Electronics	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆		◆			◆							
A.E.L.																			◆					
Amateur Comps		◆	◆							◆														
Ambit					◆	◆							◆											
Anco			◆		◆		◆			◆	◆													
Astro Electronics																								
Bamber							◆	◆	◆	◆										◆	◆			
Baron																								
Barrie							◆	◆		◆														
Bazelli								◆					◆	◆	◆									
Bi-Pak	◆	◆	◆		◆		◆	◆		◆	◆										◆		◆	
Birkett	◆	◆	◆	◆	◆	◆	◆					◆		◆				◆						
Boss Ind							◆	◆	◆	◆														
Bull	◆		◆		◆			◆	◆	◆										◆	◆	◆	◆	◆
Bywood				◆		◆		◆		◆				◆		◆		◆						
Cambridge																								
Cambs Learning Ent																								
Catronics		◆	◆	◆		◆	◆			◆			◆			◆		◆			◆			
Chromasonic	◆	◆	◆	◆			◆	◆	◆	◆		◆						◆						
Copper Supplies																								
Crofton		◆			◆	◆	◆									◆		◆						
C.W. Electronics	◆		◆		◆		◆			◆		◆											◆	
Decon																								
Denco												◆									◆			
Doram	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆				◆		◆	◆		◆	◆
Eagle																								
Electronic Brokers																								
Electronic Equipment																								
Electroni-Kit																								
Electro-Tech	◆	◆	◆	◆	◆	◆		◆	◆	◆		◆									◆		◆	
Electrovalue	◆	◆	◆	◆	◆		◆		◆	◆													◆	
Greenbank		◆	◆	◆		◆												◆						
Greenwood	◆	◆	◆	◆	◆		◆	◆	◆	◆											◆			
G2DYM Aerials																								
Adam Hall											◆												◆	
Harmsworth																								
H.B. Electronics	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆							◆					◆	
H.M. Electronics		◆			◆	◆	◆	◆						◆	◆									
Home Radio	◆	◆	◆		◆		◆	◆	◆	◆	◆	◆	◆	◆						◆	◆		◆	◆
Interface Quartz																		◆	◆					
L.B. Electronics																								
Lektropaks		◆	◆	◆	◆		◆	◆	◆	◆	◆													
Lynx																							◆	

FOLD BACK

FOLD BACK

	Heatsinks					Knobs						Meters					Opto-Electronics				Speakers						Test Equipment				Miscellaneous					
	Couplers	Discrete device	IC types	Power	Heat conducting paste	Collet	Plain	Skirted	Winged	Pointer	Slider	Panel	Edge	Multi	Frequency	Megger type	Opto-isolators	Infra-red	7 segment	Matrix	Ear	Miniature	High power	Cabinets	Complete	Piezo-electric	Oscilloscope	Signal Generator	Counter/Timer	Bridge	Aerials	Books/Courses	Breadboards/kits	Solar Batteries	Stand-offs	Dry Transfers
A1 Radio	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆										◆	◆									◆			◆		
A.D. Electronics																	◆	◆	◆	◆			◆	◆	◆											
A.E.L.																																◆				
Amateur Comps		◆		◆			◆	◆		◆		◆		◆							◆	◆	◆	◆	◆		◆		◆		◆					
Ambit			◆									◆	◆								◆															
Anco		◆		◆		◆	◆	◆		◆	◆	◆	◆	◆	◆	◆		◆	◆		◆	◆	◆	◆	◆	◆						◆	◆			
Astro Electronics				◆								◆					◆						◆	◆									◆	◆		
Bamber			◆									◆																				◆				
Baron																			◆																	
Barrie							◆					◆	◆	◆		◆					◆	◆	◆				◆	◆		◆		◆	◆			
Bazelli																																				
Bi-Pak		◆		◆			◆	◆		◆	◆	◆	◆	◆					◆		◆	◆	◆								◆	◆			◆	
Birkett				◆			◆	◆		◆	◆	◆	◆	◆			◆		◆		◆	◆	◆	◆						◆	◆	◆				
Boss Ind																																	◆			
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Bywood																			◆	◆								◆	◆				◆			
Cambridge															◆													◆					◆			
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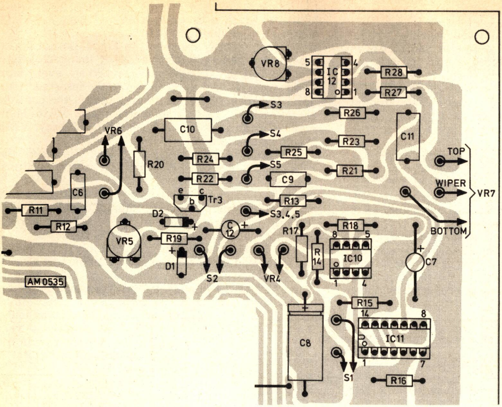
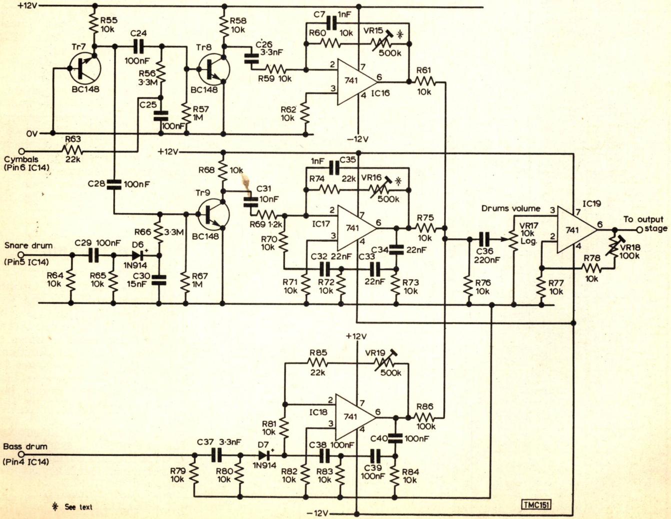


Fig. 2: left, assembly and interwiring diagram for the part of the main circuit shown in Fig. 1.

Fig. 3: below, is the circuit for the Drum and Rhythm part of the organ.



Drum and Rhythm Section

Fig. 3 shows the drum and cymbal voicing circuits. Tr7 is used as a white noise generator and feeds the cymbals and snare drum stages. Cymbal pulses from the rhythm generator IC are used to gate white noise through Tr8. The envelope of the gate is set by C25 with R63 and R56. The noise is filtered at top and bottom by C26 and C27 respectively. VR15 is used to balance the cymbal level with that for the other instruments.

The snare drum circuit is a little more complex. A sharp burst of white noise is generated at the collector of Tr9 when the trigger is received from the rhythm generator. This is fed to IC17 which is connected as a low-frequency phase-shift oscillator. VR16 is set so that the circuit is just NOT oscillating. When the white noise burst arrives it triggers a decaying oscillation in this stage and mixes with the frequency so produced. Some care is needed in setting VR16 for optimum results but the sound is quite realistic. The bass drum sound is produced by using the rhythm pulse to trigger a similar phase shift oscillator which is tuned to a lower frequency. VR19 controls the oscillation point.

Assembly details are shown in **Fig. 4**. Do not insert the rhythm generator chip (IC14) at this stage. Note that this is an 18-pin package. When everything **apart from IC14** has been correctly inserted, temporarily connect VR17 to its pins and set the controls as follows: VR15 Minimum resistance, VR16 Minimum resistance, VR17 Midway, VR18 Midway, VR19 Minimum resistance.

Connect the power supply. Slowly increase the value of VR19 until oscillation just starts then turn it back slightly so that it just stops again. With a flying lead, momentarily touch +12V to the top end of R79. You should hear a "thump" similar to that from a bass drum. Adjust VR19 for the correct amount of decay. Use VR18 to preset the level.

Now test the snare-drum circuit. Apply +12V pulses to the top end of R64 and adjust VR16 for best results. Try to achieve a reasonable balance with the bass drum. A 100kΩ component for VR16 would make for easier adjustment. After building several models it was found that the best setting is very close to the bottom end if the original 500kΩ potentiometer is used.

Finally, test the cymbals by applying +12V to the end of R63 going towards the rhythm generator and adjust VR15 until the sound is realistic. As with the snare drum circuit, adjustment may be easier with VR15 as a 100kΩ component.

The quality of the cymbals is to some extent controlled by Tr8. There is a large variation in gain for this device and a very high gain might saturate the device with the trigger pulse. This can be detected by a kind of "hesitation" at the beginning of the cymbal sound. It is remedied by reducing the value of R58 from 10kΩ to 4·7kΩ.

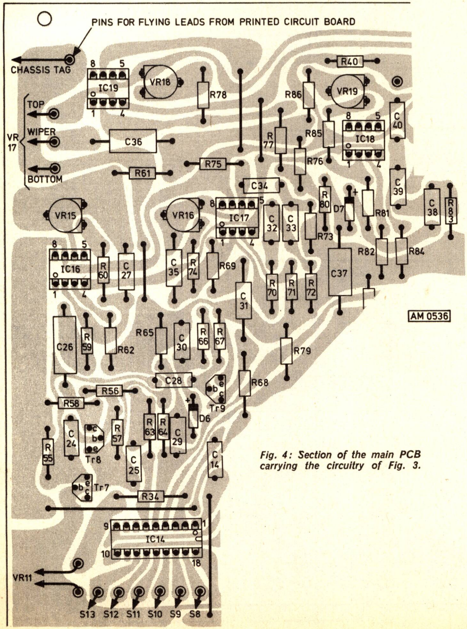


Fig. 4: Section of the main PCB carrying the circuitry of Fig. 3.

Accompaniment Circuits

The Accompaniment circuits are shown in **Fig. 5** and the assembly details of this stage in **Fig. 6.** IC14 is the rhythm generator the speed of which is controlled by VR11. Rhythms are selected by the switches S8 to S13 singly or in any combination. The switches couple the rhythm select inputs with the "Any Key Down" signal produced by the chord generator. This ensures a synchronised start of rhythm at the instant an accompaniment key is depressed.

The chord waveform is different from the simple square

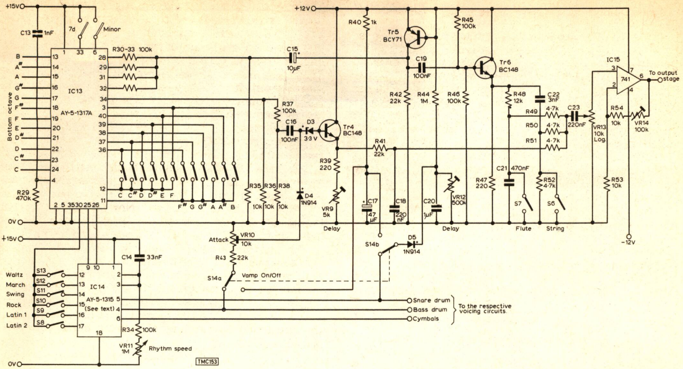


Fig. 5: The last part of the circuit to be described is for the Accompaniment.

★ components

Melody Section

R11	33kΩ	VR8	100kΩ sub miniature preset
R12	1kΩ		
R13	470Ω	C6	220nF
R14/15	4·7kΩ	C7	2·2µF 15V tantalum
R16	3·3kΩ	C8	100µF 25V
R17	22kΩ	C9	100nF
R18	4·7kΩ	C10	1nF
R19	10kΩ	C11	220nF
R20	220Ω	C12	2·2µF 15V tantalum
R21	4·7kΩ	D1/2	1N914
R22	10kΩ	Tr3	BC148
R23	4·7kΩ	IC7/9	AY-1-1313
R24	22kΩ	IC10	555
R25/26	4·7kΩ	IC11	4011
R27	1·2kΩ	IC12	741
R28	10kΩ	S1/5	single pole one way toggles (5 off). Rocker Tabs for conventional keyboard version. Keyboard switches (depending on version being built).
VR4	100kΩ linear		
VR5	10kΩ sub-miniature preset		
VR6	5kΩ linear		
VR7	10kΩ log. (ganged with mains switch if conventional keyboard version is constructed)		

Drums and cymbals section

R55	10kΩ	VR16	500kΩ sub miniature preset but see text
R56	3·3MΩ		
R57	1MΩ	VR17	10kΩ log
R58	10kΩ* See text; this resistor might need reducing to 4·7kΩ	VR18	100kΩ sub miniature preset
		VR19	500kΩ sub miniature preset
R59/62	10kΩ		
R63	22kΩ	C24/25	100nF
R64/65	10kΩ	C26	3·3nF
R66	3·3MΩ	C27	1nF
R67	1MΩ	C28/29	100nF

R68	10kΩ	C30	15nF
R69	1·2kΩ	C31	10nF
R70/73	10kΩ	C32/34	22nF
R74	22kΩ	C35	1nF
R75/84	10kΩ	C36	220nF
R85	22kΩ	C37	3·3nF
R86	100kΩ	C38/40	100nF
VR15	500kΩ sub miniature preset but see text	D6/7	1N914
		Tr7/9	BC148
		IC16/19	741

Bass and Accompaniment Section

R29	470kΩ	C16	100nF
R30/34	100kΩ	C17	47µF 25V
R35/36	10kΩ	C18	220nF
R37	100kΩ	C19	100nF
R38	10kΩ	C20	1µF
R39	220Ω	C21	470nF
R40	1kΩ	C22	3nF
R41/43	22kΩ	C23	220nF
R44	1MΩ	D3	3·3V 400mW zener
R45/46	100kΩ	D4/5	1N914
R47	220Ω	Tr4	BC148
R48	12kΩ	Tr5	BCY71
R49/52	4·7kΩ	Tr6	BC148
R53/54	10kΩ	IC13	AY-5-1317A
VR9	5kΩ sub miniature preset	IC14	AY-5-1315 (pattern 004—Jubilee)
VR10	10kΩ sub miniature preset	IC15	741
VR11	1MΩ linear	S6/13	single pole one way toggles (8 off)—rocker tabs for conventional keyboard version
VR12	500kΩ sub miniature preset		
VR13	10kΩ log		
VR14	100kΩ sub miniature preset	S14	double pole change-over toggle or rocker tab with similar pole configuration
C13	1nF		
C14	33nF		
C15	10µF 25V		

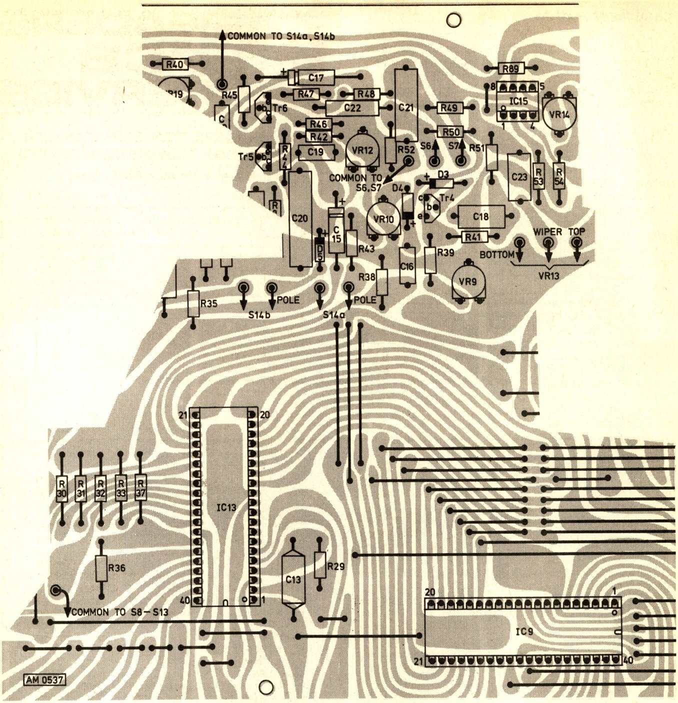


Fig. 6: Assembly details for the circuit shown in Fig. 5.

wave produced in the melody circuits in that it is more akin to a staircase which constantly changes its shape (depending on the harmonic relationships between the three or four elements it comprises). The simple emitter follower type of envelope shaper would introduce asymmetric distortion. Tr5 in conjunction with R42 acts as a voltage controlled attenuator. The mixed chord signal is applied to its collector via C15 and taken from this same point via C19 for further processing. If Tr5 is "turned on" the signal is shunted to the positive rail and its amplitude falls to nearly zero. The transistor is biassed so that this is the usual condition. When it is turned off—by means of the snare-drum pulse—the signal momentarily rises at the collector and then dies away as the charge on C20 is shunted to ground through VR12. This gives a percussive attack and a reasonable sustain; the latter being preset by VR12. If S14b is in the "Vamp OFF" position a steady DC level is maintained on C20 and this holds Tr5 permanently off. In this condition any signals from the chord generator are unaffected by the envelope shaper.

The envelope shaper for the alternating bass is similar to the emitter follower circuit used for the melody rail except that it produces a slightly larger signal (to allow for losses in the heavier filtering which is applied to it). A zener diode (D3) is used to back off the transistor's Veb so that larger signals can be applied without them appearing at the emitter prematurely.

Last Assembly

Complete the assembly of this stage by reference to Fig. 6. Insert Soldercon sockets for IC13 and IC9 but do not insert these ICs yet. Wire in temporary links between the pole pins of S14a and b to the DC level (at the pin adjacent to R45)—this disables the Vamp and will make initial testing easier. Temporarily short out R35 to inhibit chords. Refer to Fig. 4 which shows the position of IC14 and connect a temporary link between the pin labelled "S13" and "Common". This selects the waltz rhythm. Wire VR11 and VR13 to their respective pins. Set all controls as follows: VR9 to minimum resistance, VR10 to "ground" end of track, VR11 midway, VR12 to maximum resistance, VR13 midway, VR14 midway.

Connect the power supply and loudspeaker but *before* turning on insert ICs 13 and 14. *Take great care not to damage the pins.* Double check the orientation of these two ICs (they are expensive!).

You can now apply power and should, initially, hear nothing from the loudspeaker. Depress the key marked for the chord of C or, alternatively, use a piece of wire with clips to bridge the contacts in the position of this switch. Slowly move the wiper of VR10 away from ground to produce the bass note. It will be alternating and its speed should be adjustable with VR11. There should be no percussion or sustain at this stage. Set VR10 so that there is no further increase in volume as it is adjusted. If necessary adjust VR14 for correct level.

Final Steps

Switch off the power and remove the link between the pole of S14a and the DC level pin. Now insert a link between the pole and its adjacent pin (which carries the bass drum pulses).

Re-apply power to hear the alternating bass with percussion and sustain. Adjust VR10 to remove undesirable clicks and then set VR9 for sustain period. Try different chord selections by pressing other keys and you should find that the pairs of bass notes change accordingly.

Removing the shorting link across R35 should produce static chords—depending on the key you are depressing. Try the 7th and Minor select keys in conjunction with the selected chord.

Switch off the power and re-connect the pole pin for S14b to its immediately adjacent neighbour (carrying the snare-drum pulses). Re-apply power and you should now hear rhythmic chords interspersed with the alternating bass. Adjust VR12 for the best duration of chord sustain.

Insert IC9 and then refer to Fig. 2 in Part 2 and insert ICs 7 and 8—at the same time checking all the top side wiring links.

Board assembly is now complete and all the stages have been tested and initially adjusted. Remove all temporary leads. Remember to replace IC12 and IC19.

Next month—the final stages—assembly into the cabinet.

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DESIGN YOUR OWN PROJECTS

No. 3

CAR COURTESY LIGHT

TOBY BAILEY & BOB WHITAKER

Courtesy lights in cars can be very annoying. You get into your car at night, sit down, shut the door and the light goes out; leaving you fumbling in the dark trying to insert the ignition key! Most, if not all, of these problems can be solved by an appropriate circuit which keeps the light on for a few seconds after the door is closed—besides, this provides us with an interesting design exercise!

Specification

Assuming that the car has a negative earth power supply, the circuit in the car before modification will consist of a 12V supply driving the light bulb, with a switch, operated by the door, in the positive line. We want our circuit to supply current to the light for about fifteen seconds after the switch is opened. This arrangement is shown in **Fig. 1**.

Design

Well then, how are we going to set about doing this? The only way that springs readily to mind (ours at any rate) is to charge up a capacitor when the switch is on and to let it discharge when the switch is turned off. After all, most timing circuits are based on this principle! Unless we are going to become involved with relays and the like we will need a series pass transistor in parallel with the switch to turn on the light after the switch is turned off. The arrangement will be something like that in **Fig. 2**.

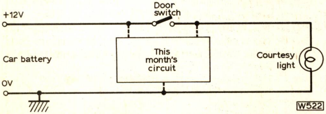
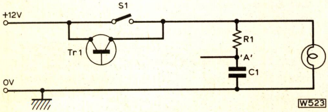


Fig. 1: Above, the normal car courtesy light plus our circuit gives a worthwhile advantage. Fig. 2: below, is the germ of the idea. Don't worry about the incomplete transistor! All will be revealed later.



R1 is the resistor through which we charge up capacitor C1. We haven't drawn an emitter on the pass transistor yet, this is because we've not decided whether it's going to be PNP or NPN! Anyway, there's a slight problem with the circuit as it stands. We want Tr1 to turn on when the voltage at point 'A' reaches a sufficiently high value: we then want C1 to discharge slowly when S1 is turned off. However, C1 will charge up just as effectively through Tr1 as through the switch, so there's no way that we can discharge C1 when S1 is turned off again. Hence, with the present arrangement, the light will never turn off. Somehow we have to isolate the effects of the switch and the transistor for the purpose of charging up C1.

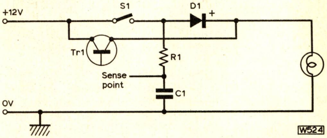


Fig. 3: The diode D1 turns out to be the critical component in this month's circuit.

A small amount of thought produced the following simple modification: we insert a diode between the switch and the light, so that the transistor is in parallel with both. We then take the charging resistor from the switch side, **Fig. 3**. Now when the switch is closed C1 will still charge up and we can use the voltage at the sense point to hold Tr1 on. The difference now is that when S1 is off and Tr1 is on, D1 will be reverse biased and hence no current can pass through R1. This allows us to discharge C1, in some manner yet to be specified!

Having solved that problem, how are we going to fit those two 'dangling wires' in **Fig. 2** together? It's fairly obvious that we're going to need another transistor and that we want it to turn off when the voltage at the sense point becomes low enough. We can then

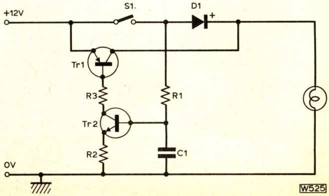


Fig. 4: A second transistor and a working circuit at last.

★ components

R1 100kΩ R2 6·8kΩ both ¼ or ⅓W carbon
C1 2·5μF 25V electrolytic C2 0·68μF
Tr1 OC35 Tr2 2N3702 Tr3 2N3704 D1 1N4001
The lamp and the switch S1 are part of the car wiring

use this transistor to control Tr1. If we use an NPN transistor here then Tr1 will have to be PNP to make them fit together sensibly, as in **Fig. 4.**

You can see that two additional resistors have appeared as well as Tr2. We've included R3 to limit the base current in Tr1—it should stop anything nasty happening! If we don't include R2 then C1 will be discharged very rapidly. This is because Tr2 will saturate and then pass a large current through the forward biased diode of its base-emitter junction. With R2 in the circuit the emitter of Tr2 will just float up to about 0·5V below the capacitor voltage: the current drawn from the capacitor is just the current through the emitter resistor divided by the gain of the transistor. On further consideration, what on earth do we need R3 for? The current that flows in the base of Tr1 is just Tr2's collector current; since R2 will limit this anyway we don't need R3 as well. Also, R3 would be a bit of an embarrassment if it caused Tr2 to saturate so, on second thoughts, let's dispense with it.

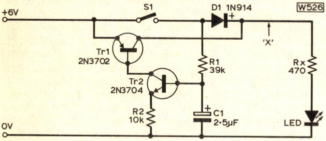


Fig. 5: The test circuit for the idea, using an LED instead of the car's lamp bulb. Note the use of a 6V supply here.

At this stage it's probably a good idea to play with the circuit on S-Dec to make sure that it works. **Fig. 5** shows the circuit we assembled; the 6V supply and the LED were used merely because they were nearest to hand. This arrangement gives a good idea of the feasibility of the circuit so far developed. 10kΩ seems a reasonable sort of value for R2, although we could have used any of a wide range of values equally well. It should keep the current drawn from C1 small and prevent excess base current in Tr1. The choice of 39kΩ for R1 is also fairly arbitrary—it charges C1 quite quickly. Rx limits the current in the LED to around 10mA. With these values the circuit works with a delay of about five seconds: so far so good. However, the light turns off rather slowly, taking a couple of seconds after the light starts dimming before it is completely extinguished. The problem is that at the turn-off point the current being drawn from C1 is very small and so everything happens very slowly. We could try sticking a resistor across C1 to increase the current drawn at turn-off but then we'd need a much larger capacitor, since it would discharge very quickly to start with. We must be able to do better than this!

Surely the way to get fast switching is to use positive feedback, i.e. regenerative switching. The only way to produce positive feedback here is somehow to connect the point marked 'X' in **Fig. 5** to the base of Tr2. We don't want to use a resistor since this will mess up our biasing and the whole business then becomes very confused. What happens if we use a capacitor to provide the feedback? It certainly should speed up the switching in the critical region: as soon as the light starts to turn off the voltage at point 'X' will start to drop and since the voltage drop across a capacitor can't change instantaneously, the voltage at the base of Tr2 will also be forced down. For our first try the use of a 0·68μF capacitor produced rather a strange result—the LED flashed a few times as it turned off. Perhaps something like that was to be expected; after all we have very nearly constructed an oscillator! With further trials we found that a 0·1μF capacitor had little effect, that 0·47μF produced a vast improvement in switching speed without any untoward effects and that larger values (about 2μF electrolytic) also speed up switching with no hint of oscillation. Having reached this stage it's now time to design the complete circuit for a proper light bulb; we can find the optimum value of 'speed-up' capacitor by trial and error.

A quick attack on the car produced the information that the interior light is rated at 12V 6W. From this it doesn't require much mental strain to work out that we will need to supply about 0·5A to keep the bulb alight. Of the selection of power transistors that we possess an OC35 seems to be the most suitable—

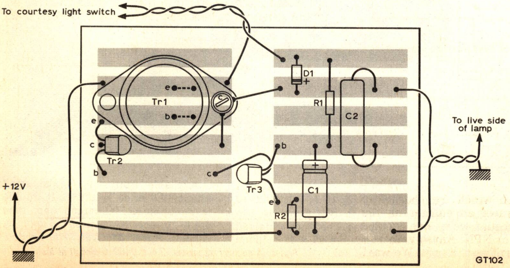


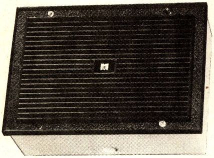
Fig. 7: The final circuit can be built up on a piece of stripboard as shown here. In the author's unit the board was stuck in the bottom of an aluminium die-cast box with flexible leads coming out for the switch, supply and lamp.

PRODUCTION LINES

bill tull

Protection racket

Not a lot to look at is it? but then a burglar alarm should be fairly unobtrusive in order that it can perform its task to the best of its ability. This latest one from ADE (Security) Co. is called the Maxi-guard Mk 4, and is designed around ultrasonics with an operational range of between 6ft and 30ft. When the device is properly set up it transmits a frequency of 40kHz, and provided there is no movement within the room the same frequency is returned to the units built-in receiver. However, if there is something in the room that moves, the frequency of the returned signal is altered (Doppler effect), activating the alarm.



The Maxi-guard operates from a 12V DC source and draws approximately 100mA. Measuring 181 × 126 × 64mm, it can be obtained from the manufacturers for £35·00 plus 12½% VAT.

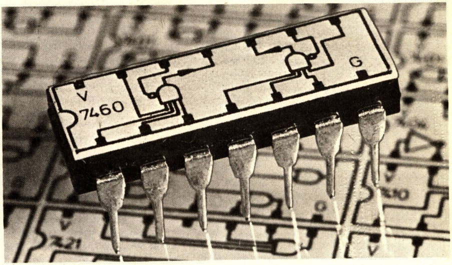
ADE (Security) Co., 217 Warbreck Moor, Aintree, Liverpool. Tel: 051-525 3440.

So simple

Unless you happen to possess a photographic memory, the constructor using TTL IC's almost always has to refer to data books for correct pin configuration. A simple, yet highly effective idea from Concept Electronics, is IC-size self-adhesive printed labels showing pin-outs for the 61 most popular 14 and 16 pin ICs. Aptly named Stickies, they are attached to the top of ICs and can be used for constructing and fault finding in prototypes, designing PCB layouts, fault finding on production circuits, and are invaluable as a teaching aid.

Available in sets of 450, they are packed in a re-usable plastic folder complete with comprehensive instructions. Also included in the pack is a list of equivalents which extends the range of Stickies to cover 86 ICs. Priced at £2·80 for the pack, further details can be obtained from:—

Concept Electronics, 8 Bayham Road, Sevenoaks, Kent. Tel: 0293 514110.

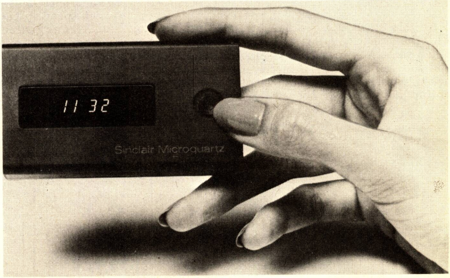


Quartz controlled

A rather smart looking digital clock has recently been announced by those wizards of miniaturisation—Sinclair Radionics. Finished in matt black, the Microquartz GT is primarily designed for use in the car, although it's equally effective fixed on a desk, bedside table or workbench. Fixing is by means of adhesive pads.

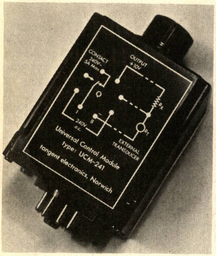
All time settings are adjusted by the touch of a button, and as the unit is quartz controlled, it is claimed to operate for up to two years on two pen light batteries. The black anodised alloy case measures 90 x 45 x 16mm and weighs in at 3oz.

Available from the normal retail shops, the price is £12·95. If trouble is encountered in getting one, then apply direct to *Sinclair Radionics, London Road, St. Ives, Huntingdon, Cambs. Tel: 0480 64646.*



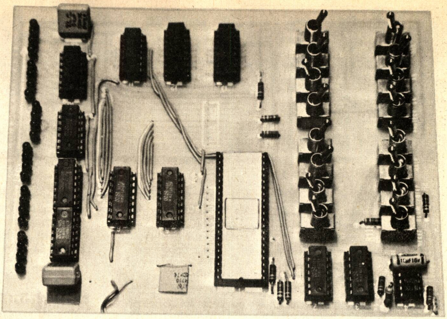
5-way controller

Plug it in, connect an external transducer and 240V AC and what've you got? Well you've got a temperature controller; a light controller; a variable time delay; a liquid level sensor or a touch switch. To perform any of these control functions it is only necessary to connect a transducer between terminals 5 and 6 (thermistor for temperature control, capacitor for timing control, light dependent resistor for lighting control etc.) and a resistor of similar resistance to the transducer between terminals 6 and 8. Also as this 5 in 1 module operates from the mains it generates its own internal isolated supply of +10V DC at terminal 5. Called the Universal Control Module, it contains its own internal comparator and the level required is obtained by adjusting the knob at the top of the module. The internal single pole/change over contact is rated at 240V 5A AC or 30V 5A DC.



For one-off the price is £14·95 plus VAT, and for an extra £4·80 a kit containing resistors, capacitors, a light sensitive resistor, thermistor etc. can be obtained.

Tangent Electronics, 136 Whitehall Road, Norwich, Norfolk. Tel: 0603 28015.



Legal "Scrumping"?

Mention the words Microprocessor system to the average enthusiast and he'll draw in his breath and mention things like the cost of petrol going up, and food isn't getting any cheaper and that he'd like to indulge but just can't afford it. If that person is you—then read on because Bywood Electronics have launched a system, which at £55 is claimed to be more price competitive than any other system available. With the rather unusual and mnemonic name "Scrumpi" it has nothing to do with apples, but is designed for the engineer or student who wishes to obtain experience of using and designing with microprocessors.

All parts are supplied in the Scrumpi kit, which incidentally is based on the National Semiconductor SC/MP eight-bit microprocessor. The switches are soldered to the PCB by their terminals while the circuit needs a power supply of +5V and −7V and these can be derived from a single 12V supply with a five volt Zener diode. Comprehensive instructions and operating data are provided with Scrumpi along with details for the SC/MP microprocessor.

Bywood Electronics, 68 Ebberns Road, Hemel Hempstead, Herts. Tel: 0442 62757

Master meter

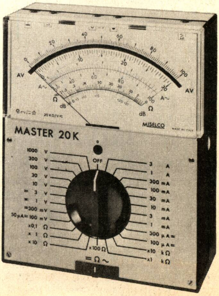
A new arrival from Alcon Instruments is a 20kΩ/V multimeter with claimed accuracy figures of 1·5% on DC and 2% for AC. Called the Master 20 it is available in two versions—standard and USI. The latter model derives its name because it incorporates a Universal Signal Injector capable of supplying a 1kHz-modulated 500kHz 20V output, rich in harmonics and detectable up to 500MHz.

Both models feature a DC range capable of measuring from 100mV to 1kV and currents from 50μA to 3A; an AC range which measures from 10V to 1kV and currents from 1mA to 3A and resistance ranges from 200 ohms to 20M ohms.

Optional extras include a 30kV probe which extends the DC voltage range for servicing TV's, 'scopes etc.

The Master 20 measures 170 x 140 x 62mm and is supplied with leads, prods and instructions. For the standard model the price is £37·15 and for the USI model £41·90. The 30kV probe is £16·95.

Alcon Instruments Ltd., 19 Mulberry Walk, London SW3. Tel: 01-352 1897.



OF THE MONTH 64

Brian DANCE M.Sc

FERRANTI ZN1034E TIMER

Quite a number of monolithic timer devices are now on the market, the "555" being one of the best-known types. Although the economical 555 can provide a very wide range of delay times from about 5µs up to some minutes, it is not suitable for a long delay time of the order of an hour or a week. The problem of using an analogue timer to obtain very long delays is that the product of the timing resistor value and of the timing capacitor value must be very large. However, one cannot employ a large value electrolytic capacitor if one requires an accurate delay time, since this type of capacitor has a large tolerance in its value and the value can change with time. In addition, the leakage current of such capacitors makes it impossible to employ a large value of timing resistor.

The ZN1034E

A recent device from Ferranti employs an analogue timer, but the same chip also incorporates a 12-stage frequency divider. Thus the basic oscillator must pass through 4095 cycles before the timing period is terminated. One can therefore employ moderate values of the timing components and multiply the oscillator period by a large factor.

It is not usually necessary to employ an electrolytic capacitor to control the timing of the ZN1034E oscillator. Successive timing periods can therefore be repeated very accurately, to within about 0·01 per cent. Similarly the change of the timed period with temperature can be as low as 0·01 per cent per °C if the temperature coefficients of the timing resistor and capacitor are very low.

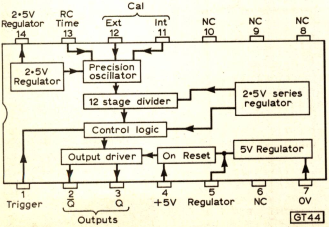


Fig. 1: Connections for the ZN1034E timer IC together with the internal circuit shown in block form.

The ZN1034E device is supplied in a 14-pin dual-in-line package with the connections shown in **Fig. 1**, but electrically similar devices are available in an 8-pin dual-in-line and in a 10-lead circular metal can under the type numbers ZN1034P and ZN1034T respectively.

Power supply

If a 5V regulated supply (as used with TTL circuits) is available, pin 4 should be connected to the +5V line and pin 7 to the 0V line. A 0·1µF capacitor should be connected directly between these pins to provide high frequency decoupling. Alternatively a supply of 6V up to 450V can be used in the type of circuit shown in **Fig. 2**. The positive line is connected through a dropping resistor R_D to pins 4 and 5. The internal regulator connected to pin 5 ensures that the correct voltage of +5V is applied to pin 4.

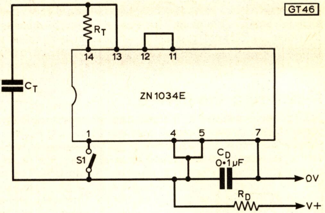


Fig. 2: The ZN1034E with its input and timing circuits and power supply connections.

The value of R_D in kΩ is given by the equation:—

$$R_D = \frac{(V^+ - 5)}{(I+7)}$$

where I is the load current in mA. Additional decoupling may be required if the supply voltage should exceed 50V. The current consumption of the ZN1034E is about 5mA plus any current taken from either of the outputs.

Timing

The timing resistor (R_T in **Fig. 2**) should have a value of between 5kΩ and 5MΩ, but for optimum linearity and performance, the value should be between 50kΩ and 1MΩ. The product of the values of

R_T and C_T sets the period of the internal oscillator. If the value of C_T exceeds 68nF, the delay period is 2700 multiplied by R_TC_T if pins 11 and 12 are joined so as to bring the internal calibrating resistor of 100kΩ into circuit. Typical values of R_T and C_T and the time delays which can be obtained by multiplying R_TC_T by a large factor are shown in Table 1.

The value of C_T should exceed 0·01μF for optimum performance; although smaller values may be employed when the timed period must be short, the period is then not linearly related to R_TC_T. The minimum recommended value of C_T is 3·3nF. For very long delays, electrolytic capacitors are convenient, but they do not provide such accurate timing.

TIMING COMPONENTS			TIMED PERIOD	
C_T (μF)	R_T (Ω)	R_TC_T	$2736R_TC_T$ (Pins 11 and 12 joined)	$7500R_TC_T$ (300Ω from pin 12 to earth)
0·01	39k	0·39ms	1 sec	2·91 sec
0·1	220k	22ms	1 min	2·74 min
1	100k	100ms	5 min	12·5 min
1	1·2M	1·2 sec	54 min	2·5 hours
10	1·2M	12 sec	10 hours	27 hours
10	3·3M	33 sec	1 day	2·7 days
100	2·2M	220 sec	1 week	2·7 weeks

Table 1: Giving various values of R and C that can be used with the timing circuit of the ZN1034E.

An internal calibration resistor of 100kΩ in value is connected in circuit when pins 11 and 12 are joined; the delay time is then equal to about $2736R_TC_T$. If, however, an external calibrating resistor of 300kΩ is connected between pin 12 and earth (pin 7), the timed period is $7500R_TC_T$. The multiplying factor can also be fixed at 2500 by the use of a 50kΩ resistor between pin 12 and ground or at 4100 with a 150kΩ resistor.

Measuring the period

The basic oscillator period can be measured by connecting a probe to pin 13, but the probe impedance should not be less than $10R_T$ or it will cause a considerable change in the period of oscillation. For short times the output from this pin should be viewed on an oscilloscope, but for long times a stop watch is convenient. The total delay time is 4095 times the period of the oscillator. The measurement of the period of the basic oscillator is much quicker than the measurement of the whole of a long timed period at the output of the frequency divider circuit, but the measurement of the total timed period at the output will normally provide a more accurate value of this period.

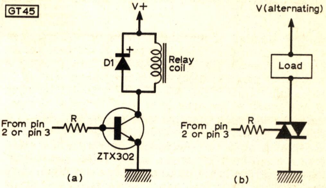


Fig. 3: Two types of output circuit suitable for the timer.

Starting up

The timing in a ZN1034E circuit may be started by joining pin 1 to earth by closing the switch S1 in **Fig. 2** for a moment. The timing process is then unaffected by any further operation of S1. Alternatively, if pin 1 is earthed, timing will begin immediately the power is first applied to the circuit.

Output circuit

Two complementary outputs are provided from the ZN1034E. The output at pin 2 is normally at a low voltage, but rises to +3·6V at the end of the complete timed period. On the other hand, pin 3 is normally at a 'high' voltage, but this voltage falls from about +3·0V to a 'low' value at the end of the

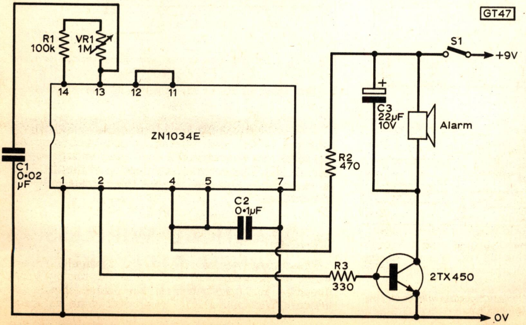


Fig. 4: Here the timer is used in an alarm circuit which can provide delays from 1 to 11 minutes. The transistor type should be shown as ZTX450.

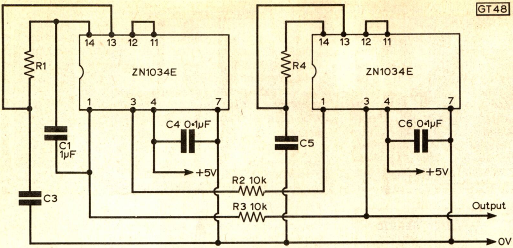


Fig. 5: Two ZN1034E chips are used here to extend the timed period to a week or more.

timed period. Either output can deliver or accept up to 25mA.

A typical output circuit for the operation of a relay is shown in **Fig. 3**(a). At the end of the timed period, the output from pin 2 rises in voltage and this causes the ZTX302 NPN transistor to conduct. A current therefore flows from V^+ through the relay coil and the relay closes. The V^+ supply in **Fig. 3**(a) is chosen to suit the relay used. The diode D1 suppresses transient voltages developed in the relay coil and hence protects the ZTX302 transistor.

If the resistor R of **Fig. 3**(a) is connected to pin 3 of the ZN1034E instead of pin 2, the relay will be closed during the timed interval and will open at the end of the interval. The resistor R of **Fig. 3**(a) must limit the current flowing from the ZN1034E output to a value no greater than 25mA. A value of a few hundred ohms is suitable with a minimum value of about 150Ω. **Fig. 3**(b) shows how the output from a ZN1034E can be used to control a triac device which itself switches the power to a load on or off. As before, R must limit the ZN1034E output current to 25mA.

Minute timer

In **Fig. 4** the product R_TC_T can be varied from 0·02 to 0·22 second by increasing VR1 from 0 to 1MΩ. When multiplied by the 2700 factor, times of 1 to 11 minutes can be obtained. Timing starts when S1 is closed and power is applied to the circuit. The alarm sounds at the end of the timed period and continues to sound until S1 is opened. A suitable alarm is obtainable from Doram Electronics Ltd.

Repetitive timer

The circuit of **Fig. 5** shows how a second ZN1034E can be started at the end of the timed period of the first device. At the end of the period timed by the second device, the timing process is started again in the first device. Thus this timer circuit continues to operate with each device working in turn. The output from pin 3 of either device provides the signal through R2 or R3 which begins the timing in the other device. Thus one has an oscillator with a period which can exceed a week!

A wide selection of other circuits is included in the ZN1034E data sheet including (i) a battery charger which can accurately charge nickel-cadmium cells for a known period at a known current (ii) a metronome (iii) a timer for periods of 1 minute to 1 hour (iv) a 0 to 1 hour industrial timer with suppression against noise pulses (v) a delayed windscreen wiper motor control for vehicles (vi) the use of two ZN1034E devices in cascade to obtain a very large pulse division factor and hence delays of up to a year with an accuracy of 6 minutes after calibration. Other applications include the use of the device on farms for watering, etc, at the required times. ●

KINDLY NOTE!

ATOMIC TIME RECEIVER

August 1977

The author has kindly supplied further information on the coil assembly T1. An alternative to the one specified can be obtained from Hawnt Electronics Ltd., 112 Pritchett Street, Birmingham B6 4EN. This is the 10mm Vinkor LA2936 comprising parts: LA1421 pair of cores, LA1383 adjuster, DT2169 coil former, DT2341 ring, DT2342 clip (4 off) and DT2344 tag board.

The windings required are, Primary: 110 turns of 40 SWG enamelled copper wire. Secondaries: two of 20 turns each centre tapped. There are suitable holes in the PCB for this alternative assembly.

PLEASE MENTION
PRACTICAL WIRELESS
WHEN REPLYING
TO ADVERTISEMENTS

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

Not too many reports this month, with just about everyone away on holiday I suppose. With the appalling weather we are having in the south I thought that a lot of you would have been tied to your sets instead of looking after the leeks! Weather or not, it seems that quite a few of you have been doing the rounds of the rallies and other "do's".

Tom Learmonth of Cwmbran, Gwent, tells me in his first letter to the column that he has now passed his RAE. Congratulations Tom, but I have to remark that it is usually the other way round! Letters first, pass the RAE, and not another word! Tom is not too keen to get the code test over and done with although I have advised him otherwise. He is anxious to get hold of a secondhand transceiver for the 2m band, possibly for mobile work, so any offers to Tom at 10 Glade Close, Coed Eva, Cwmbran, Gwent. Incidentally, Tom studied entirely on his own for the RAE and now his Dad is thinking of having a go!

From Hastings, **Brian Harrison** has stuck to the job in hand and covered 10, 15 and 20m on SSB while **Robin Bayley** A9203, up in Kemberton, Shropshire, patiently awaits his RAE course to begin so that he can take the exam next May. In the meantime he is using his EC10 and Marconi R1475 to good advantage from 15 to 80m.

John Tye G4BYV writes from Dereham, Norfolk, concerning the lads who work continental stations via repeaters and then ask for a QSL! Frequently they have only worked over a couple of miles! John spreads his time over a wide range of bands from 2m down to 23cm where he has worked 107 different stations in 9 countries! A very creditable achievement that really means something, and all with home-made equipment.

From Trowbridge, Wiltshire, comes a complaint from **David Birch,** aged 13, who is fed up with QRM from TV sets, pointing out that according to the TV licence the "apparatus" is not supposed to interfere with other "wireless telegraphy" equipment. You are quite right Dave, but just try to get someone to do something about it! I read recently that there is a possibility of legislation in the US on this matter but I hate to think how long it will take to get it into law and then to implement it. Pity it wasn't done at the beginning, but there, it costs money! Only hope is to try screened twin feeders properly matched and to keep the set and the aerial as far from the source of QRM as possible.

J. Hodgson of Morpeth, Northumberland, comments on some strange calls heard in the "10m" band but I fear that these are rubbish from the adjacent 11m band! Unfortunately, with the improving conditions on the higher frequencies, we shall be able to hear more and more of the overseas Citizens Band stuff.

The organisers of the Worked All Britain Award have now introduced the WAB Counties Award which is also available to listeners. It is issued in two classes, depending upon the number of counties worked/heard. QSLs are not required. A record book to facilitate the "book-keeping" is really a must for this sort of award. Full details from Alec Brennend G4AVA, 76 Deneley Avenue, Todmorden, Lancs. Incidentally, as an added incentive to have a go, all profits from WAB activities go to the Radio Amateur Invalid and Bedfast Club.

Club News. The newly formed Brighton and District Radio Society is well under way and forthcoming events include a talk on Computers by G3XJG on October 12 and on the 26th G3OEM will discourse on Aeronautical Radio matters. Info from the Hon. Sec. **Nigel Hewitt** G8JFT, 74 Carlyle Street, Brighton.

The Cheltenham ARS and the local RSGB group have investigated the possibility of forming a single club and the likely date for the first combined meeting is November 3. Let's hope the move will be beneficial to all concerned. Further info from **Derek Lively** G3KII, 26 Priors Road, Cheltenham.

The very active Wessex AR Group has its AGM on October 7 and on the 21st they will be reviewing the results of their efforts in the VHF NFD. Several members were successful in the last RAE. It is expected that at least a dozen will start the new course at the Bournemouth College. Further info on the Club from **Geoff Cole** G4EMN, 6 St. Anthony's Road, Bournemouth. Meetings in the Club Room at the Dolphin Hotel, Holdenhurst Road, Bournemouth, 7.30 p.m.

Several readers have queried the new prefix P28 now being heard on the bands. This is the Republic of Djibouti previously using FL8 as a French colony. The series starts with J28AA so it's a bit difficult to tie up old calls in use with the new ones.

From Adlington, Lancs, comes a letter from **Paul Farnworth** who is listening and working for the RAE, "then I will leave school and try to get a job". Paul is 15 so let us hope that his plans work out. **John Overton** writes from Glasgow with some nice log entries on CW. He is very frustrated at not being able to answer back but perhaps it will not be for much longer as he is taking the RAE in December. His BC348 only goes to 18MHz so he's thinking of making another set for the 10 and 15m bands. Once again I must point out that a converter is the proper answer. Why not use all the other facilities you have in the 348, John? No point in duplicating them, and you are not likely to get hold of a better dial movement!

Radial, the journal of the RAIBC, reports a healthy growth in the Club membership and activities and a few volunteers are needed for jobs such as Equipment Secretary, Shows and Rallies Manager, Tapes Manager and a Transport Manager. It is not generally appreciated just how much work is involved in the transporting of gear to and from the invalid and bedfast members of the Club, apart from the odd servicing and maintenance chore.

Anyone interested in helping a most deserving cause can contact Harry Boutle G2CLP at 14 Queen's Drive, Bedford MK41 9BQ.

A report from **Alan Doherty** BRS34968 in Portrush, Co. Antrim, just made the dateline. A rare càll these days logged by Alan was Libya in the form of K5CO/5A. Not much activity there since the Forces moved out. Alan says not to be fooled by those CY calls, just read VE instead! Two other nice ones that one can go for many years without hearing were VR4DX and VR6TC, Tom Christian on Pitcairn.

Log extracts

J. Hodgson:— **20m** FG7XL JW7BK J29AI OJ0MA YB2SV 5W1AU **15m** HK3AMV HR6SWA

J. Tye:— **(G4BYV)** worked on **23cm** (1296MHz) DF8QK DK3UC PA0FWS PA0VTW PA0EZ ON6AT SM6ESG

R. Bayley:— **80m** A2GCO CT2AP KP4EJA VE4BC **40m** HK0COP JA4AKU **15m** VE7DIY 7P8BC

B. Harrison:— **20m** F0CH/FC **15m** HM2JV JA1PPC **10m** 7X2DG

A. Doherty:— **80m** FG7AN ZS5LB **20m** K5CO/5A TU2GA-VR4DX VR6TC W6OKJ/KS6 ZD7SD 3D2AN, 5W1AU **15m** WA4RQK/VQ9 ZD8RR 5N2AAX

J. Overton:— **20m** *A9XBC* C31A *SV1GR* TG9DF VP2AA VP1WS

All calls are SSB except those in italic which are CW.

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Charles Molloy G8BUS

Solar activity is on the increase according to the Swiss Shortwave "Merry-go-round" which regularly broadcasts the latest sunspot number and gives predictions, which are obtained from the Zurich Observatory. Forecasts of the number of sunspots for the coming months show a gradual rise from 27 in October to 33 in January 1978 and this upward trend is reflected in reports of DX on the higher frequencies. The writer has been listening recently on Sunday mornings at 0840 to the DX programme from Radio Australia on the new frequency of 21570kHz in the 13m band. Although beamed to Asia this transmission comes in better in the UK at this time than the frequencies in the 25m and 31m bands that are beamed to the UK.

Harold Emblem who DXes in Mirfield, in Yorkshire, reports hearing the afternoon transmission of "Sweden Calling DXers" on a new frequency of 21690kHz. HCJB in Quito Ecuador is also on a new 16m channel of 17755kHz, Radio Australia is on 15140 and 15410 in the 19m band and Radio South Africa is on 17780. Harold asks what sort of information should go into reports to this column. The exact frequency (if known) plus the date and time of reception will help readers to search for the station and some information of the gear used and the aerial will help those who intend purchasing or building a receiver or are thinking of putting up an aerial.

An interesting report comes from **Derek Taylor** of Preston in Lancashire who uses a Realistic DX160 receiver, a calibrator and a 30ft. loft aerial when operating on the shortwaves. He reports hearing the International Service of Radio Nacional de Venezuela in English at 2200 on 15400 and he received a confirmation letter from them after one month. Radio Korea (Seoul) was heard in English at 1330 on 11860kHz and the Voice of Nigeria outlet at Benin on 4932 in the 60m band was logged at 2100.

A newsletter has been received from the Bristol Pathfinder DX-Group. This club has about 20 members, mostly in the Bristol area, but DXers from anywhere in the UK are welcome. Enquiries should go to **Lawrence Bennett,** 7 Maple Avenue, Fishponds, Bristol BS16 4HJ. **D. M. Tinker** is a keen DXer who would like to know if there is a DX club in the Rotherham or Sheffield areas. Reply please to 20 Croft Road, Brinsworth, Rotherham, S Yorks S60 5AP.

Roger Fitzpatrick of Roscrea, Co. Tipperary and his friend **Sean Keevey** recovered a couple of old Pye 5-valve receivers from their respective lofts and were surprised, after blowing away the dust, to pull-in between them the following DX:—The Voice of Vietnam on 10040kHz at 1807, Nigeria on 15220 at 1615, Radio Australia on 9570 at 0800. "Have you any information on Radio Rodina?" asks Roger. Radiostantsia Rodina (Radio Station Homeland according to the World Radio Handbook translation) is not a radio station but a radio programme. It is in Russian and is carried by the external service of Radio Moscow and is intended for Russians living abroad.

Michael Walker (BRS 38836) has been listening to Radio Baghdad and he would like to know the address of this station. Write to:—Iraqi Broadcasting and TV Establishment, Salihiya, Baghdad, Iraq. **Frank Hannam** sent in a log from Colne in Lancashire. Using a Fidelity Rad 21 and a 35ft inverted-L aerial he heard the Voice of Turkey on 9515kHz at 2210 (there is a DX programme nightly at 2230), Radio Australia on 21570 at 0815 and Radio South Africa on 21535 at 1400. Frank has just been given a big box of valves and he is looking for details of a valve receiver to build.

Can you suggest a good aerial for indoor use, asks **Ian Radford** (Derby) who reports hearing Radio Australia on 9570 at 0800 and RSA on 21535 at 1700 with his Eddystone EC10 and whip aerial. You seem to be doing very well at the moment, Ian! Why not try the TV aerial? Unplug it from the TV and connect the co-ax lead to the EC10. If results are good then you can get hold of a 2-way outlet with switch from a TV dealer and switch the aerial to either the TV or the EC10 as required. Do not join all three, the TV the EC10 and the aerial together, they may not get on with one another!

"Just received a QSL card from Radio South Africa (on 21535) so it looks like the high bands are coming back" writes **W. G. Holmes-Jones** from Abergavenny, in Gwent. He uses a R209 and a home-brew 16-transistor receiver for the broadcast bands together with the choice of a Joystick, 84ft loft aerial or 45ft longwire plus an ATU and a tunable notch filter. The highlights of a very comprehensive log are Radio 4VEH Haiti on 9779 at 1130, Radio Finland 15260 at 1300 in English, Radio Australia 9570 each day at 0700 but it gets lost before scheduled sign-off at 0900 (try 21570), Radio Iran 17730 at 1930 in English, The Voice of Greece 9760 at 2200, Radio Mozambique on 6115 at 1800. Radio South Africa was heard on 15220 at 1345 with its weekly Wednesday DX programme.

"I have acquired an ex-RAF R1155 receiver which I know you are familiar with" says **Alan Spencer** who lives at Ryhall, in Lincolnshire. When connected to a 45ft long wire it produced ELWA Monrovia, Liberia, on 4770 at 2230 and Radio Nacional Espejo, Ecuador, on 4680 at 0355. Two resistors have now burnt out and Alan is unable to get hold of a circuit or manual. A. J. Brooks, 5 Farrant House, Winstanley Road, London SW11 2EJ can supply diagrams and manuals for most ex-WD and some other communications receivers. An SAE will bring a list. The paper decoupling capacitors in the R1155 are liable to leakage and it is worth doing what the writer did with his and replace the lot with modern 0·1μF 350VW capacitors. If a decoupler does short circuit then a burnt out resistor may follow. An old dodge for testing decouplers is to connect the positive lead of a voltmeter to the HT line, disconnect the wire from the live side of the decoupler and tap-on the negative probe from the voltmeter in place of the wire just removed. A good capacitor will give a kick on the meter as it charges and the needle will then go back to zero. A leaky capacitor may give a kick and the needle will return slowly to some intermediate reading

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caused by the current leaking through it. A steady reading on the meter equal to the HT volts indicates that the capacitor is short-circuit and will have to be replaced. Be careful to have the meter switched to the appropriate voltage range (to measure the HT volts) or it will have to be replaced as well!

A large mailbag this month has meant that some letters are being held over to next month. My apologies to those concerned.

BROADCAST BANDS

MEDIUM WAVE DX

by Charles Molloy G8BUS

"Readers will think I am mad, from your remarks about me in the July issue" writes **Harold Brodribb** from St Leonards-on-Sea, who has taken up the challenge of DXing with vintage radio receivers. "I am getting good results with pre-war sets provided they are maintained well and used on this high site with an outdoor aerial and ATU." Harold mentions that his CR100 has many advantages over vintage equipment. He has changed the RF valves for quieter types (the writer used 6BA6) and fitted an S-meter and a stabilised voltage supply for the oscillator. He has adapted the BFO valve to perform a dual function as BFO and product detector. The writer used the CR100, also known as the B28, for MW DXing for a number of years. Even unmodified it is a very good receiver though it too, could now almost be classified as vintage. A large number of CR100s came on the surplus market after the last war and they can still be obtained privately for quite a modest sum. They have an internal power pack and can be run direct from 240V mains. They are not too bulky, rather heavy, like most ex-WD equipment. An external speaker is required though there is space to fit one inside the metal cabinet.

A useful report of Spanish DX comes from **Declan O'Dea** who lives in Ballinasloe, Co. Galway. With a 10-transistor domestic portable he logged La Voz de Madrid on 1097kHz, R. Espana Madrid on 917, Radio Madrid on 800, R. Zaragoza 872, R. Valencia 1259, R. Sevilla 809, R. San Sebastian 1025, R. Centro Madrid 1385, R. Popular de Jerez 1385, R. Reloj Barcelona 1124 and La Voz de Gerona on 1385. From North America WINS on 1010 was logged at 0300 and there was an unidentified VOA transmission on 1295 which would be from the 600kW BBC transmitter at Crowborough in the UK. Declan would like to contact other PW readers in his area. The address is c/o Bank of Ireland, Society Street, Ballinasloe, Co. Galway.

John Little writes from Sunninghill, Berks, to say he was interested in the reference in the July issue to DXing the Middle East. He has just spent two years in Iran where DXing Europe prior to going to work at 0430 was great fun! With local stations not yet on the air, being 3½ hours ahead of London, the BBC frequently came through on 200kHz, 647kHz and 908kHz both on the built-in rod aerial and on an outside inverted L. A further illustration that it is interference (QRM) rather than distance that limits the range of DX on the medium waves.

A Realistic DX160 receiver, a MW loop and a 250ft long wire from the house to a 25ft pole at the bottom of the garden is used by **Martin Liezers** who lives in Newport, in Gwent. DX heard with this set-up between midnight and 0300 included La Voix de la Revolution, Conakry, Guinea, very strong on 1403kHz; CJON St John's, Newfoundland on 930; WNEW New York City on 1130 and an unidentified with the call KB Radio on 1520. The latter is WKBW in Buffalo NY and the complete call will be used in the formal identifications on the hour and the half-hour. Many stations try to form slogans out of their call signs and some of these will mislead the newcomer. KLOK is "Clock Radio," WIOD is the "Wonderful Island of Dreams" (Miami), KYAK is in Alaska, and there used to be a KOLD in the same territory at one time! Some call signs may help the DXer. WNEW is in New York, WBAL is in Baltimore, WBOS in Boston, WCBS is owned by the Colombia Broadcasting System, WNBC by the National Broadcasting Company and WINS was the International News Service. There are no prizes for guessing what can be heard from WPOP and WFUN!

Martin raises a couple of interesting points in his letter. He mentions "a lot of crackles which disappear at dawn" and he asks what precautions can be taken to protect the house if his long wire is struck by lightning! Static, QRN, atmospherics, are the names given to the noise heard by Martin and each crackle is caused by a lightning discharge. Since the static disappears at sunrise it must, like DX, have been propagated for quite some distance. During the summer, thunderstorms in the tropics create a considerable amount of static which travels as far as the UK after dark and, although not loud enough to interfere with local reception, it can be troublesome to the DXer. A loop will reduce static provided that the DX and the static are not coming from the same direction. Summer static is usually from the south of the UK but it can come from other directions as well.

The advice about lightning protection usually offered in radio books is that the aerial should terminate at the point of entry to the building, on the moving contact of a knife switch. The upper contact goes to the receiver and the lower to a good, short, outside earth.

Summertime ends on October 23 this year in the UK and the return to GMT will mark the start of the winter season for North American DX. It will then be possible to listen to Canada and the USA before midnight and on nights when conditions are good some DX should be heard as early as 2300. The nearest, most consistent and earliest station to appear is CJON, located in St John's Newfoundland, which transmits with a power of 25kW on 930kHz. It can be found just on the low frequency side of AFN Berlin on 935. DXers who have never heard North America on the medium waves should try for CJON. Another regular is WINS in New York City on 1010kHz which is reasonably clear of QRM once the Dutch station on 1007 leaves the air, usually around 2300.

All North American medium wave stations use call signs which are mentioned over the air frequently. The prefix C is used on Canada and either a W or a K in the United States. All stations are on channels which are multiples of 10kHz. The best DX is often heard after midnight but quite a number of stations appear earlier whenever conditions are good. Tune slowly, as all these broadcasters suffer from slow fading and are easily missed. If unsuccessful, try again a few days later. If conditions are poor one night they will probably pick up again before long.

VHF BANDS

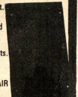
by Ron Ham BRS15744

Several contributors have expressed their pleasure at our journal's new format and the start of a series about taking the RAE. **Nigel Golds** BRS36910 West Chiltington, Sussex, leads his report with "I am pleased that there is a series which will help me with my studies for the RAE". Like many others, Nigel is a keen listener on 10m and has heard the DLs, OKs, Fs, and Gs as well as the German beacon, DL0IGI, during the periodic short skip openings in August.

While on a "junk" crawl, in aid of my early wireless

DIY SPEAKER KITS

15-WATT KIT IN CHASSIS FORM



When you are looking for a good speaker, why not build your own from this kit. It's the unit which we supply with the enclosures illustrated below Size 13" × 8" (approx.) woofer (EMI),tweeter, and matching crossover components. Power handling capacity 15 watts rms. 30 watts peak.

£17^{00} PER STEREO PAIR
+ P & P £3.40

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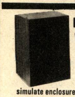

Specially designed by RT-VC for cost-conscious hi-fi enthusiasts, these kits incorporate two teak-simulate enclosures, two EMI 13" × 8" (approx.) woofers, two tweeters and a pair of matching crossovers. Easily constructed, using a few basic tools. Supplied complete with an easy-to-follow circuit diagram, and crossover components. Input 15 watts rms. 30 watts peak, each unit. Cabinet size 20" × 11" × 9½" (approx.).

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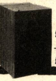
How about this for incredible bookshelf value from RT-VC! A pair of high efficiency units for only £7.50 – just what you need for low-power amplifiers. These infinite baffle enclosures come to you ready mitred and professionally finished. Each cabinet measures 12" × 9" × 5" (approx.) deep, and is in wood simulate. Complete with two 8" (approx.) speakers for max. power handling of 7 watts.



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SPEAKERS Two models – Duo IIb, teak veneer, 12 watts rms, 24 watts peak, 18½" × 13½" × 7¼" (approx.).

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Duo III, 20 watts rms, 40 watts peak, 27" × 13" × 11½" (approx.)

★ £52 PER PAIR
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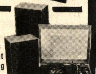
EASY TO BUILD RECORD PLAYER KIT



Ideally suited for the constructor who requires a complete stereo unit at a budget price, comprising ready assembled stereo amp. module, Garrard auto/manual deck with cueing device, pre-cut and finished cabinet work. Output 4 watts per channel, phones socket and record / replay socket

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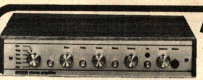
CAR RADIO KIT

Complete with speaker, baffle and fixing strip. The Tourist IV for the experienced constructor only. The Tourist IV has five push buttons, four medium band and one for long wave band. The tuning scale is illuminated and attractive small aluminium control knobs are used for manual tuning and volume control. The modern style fascia has been designed to blend with most car interiors and the finished radio will slot into a standard car radio aperture.

Size approx. 7" × 2" × 4¼". 12 volts pos or neg earth (altered internally) p & p £1.50 £12^{50}
Output 4 watts into 4 ohms.

● FREE TO PERSONAL SHOPPERS BUYING CAR RADIO KIT ELECTROMATE Rear window heater modern line element all wiring and switch worth £3^{00}



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See Below

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Superb Viscount IV unit in teak-finished cabinet. Silver fascia with alimunium rotary controls and pushbuttons, red mains indicator and stereo jack socket. Function switch for mic. magnetic and crystal pick-ups, tape, tuner, and auxiliary Rear panel features two mains outlets. DIN speaker and input sockets, plus fuse. 20 + 20 watts rms, 40 + 40 watts peak.

★ £29^{90}
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A 4 channel Stereo Adaptor to all buyers of the Visicount 20 x 20 Amplifier at £29^{90} limited offer. Available separately at £3^{95} + £1.00 p & p

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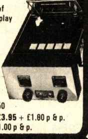
ADD-ON STEREO CASSETTE TAPE DECK KIT



Designed for the experienced D.I.Y. man. This kit comprises of a tape transport mechanism, ready built and tested record/replay electronics with twin V.U. meters and level control ready for mating together with the mechanism.

Specifications: Sensitivity – Mic. 0.85mV @ 20K OHMS; Din. 40mV @ 400K OHMS: Output – 300mV RMS per channel @ 1KHz from 2K OHMS source: Cross Talk – -30db: Tape Counter – 3 Digit - Resettable: Frequency Response – 40Hz –8KHz ± 6db: Deck Motor – 9 Volt DC with electronic speed regulations: Key Functions – Record, Rewind, Fast Forward, Play, Stop & Eject. p & p £2.50

£19^{95}

Optional extras:
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Mains transformer **£2.50** + £1.00 p & p.

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STEREO CASSETTE record/replay fully built P.C. board incorporating 4 I.C.s.	£2^{75}
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TURNTABLE illus. Popular BSR MP 60 type, complete with magnetic cartridge, diamond stylus, and de luxe plinth and cover. Ready wired

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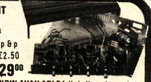
30 x 30 WATT AMPLIFIER KIT



Specially designed by RT-VC for the experienced constructor, this kit comes complete in every detail. Same facilities as Viscount IV amplifier. Chassis is ready punched, drilled and formed Cabinet is finished in teak veneer. Silver fascia and easy-to-handle aluminium knobs: Output 30 + 30 watts rms, 60+60 peak.

p & p £2.50
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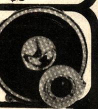

This matching loudspeaker system is hand made, kit comprises of two 8" diameter approx. base drive unit, with heavy die cast chassis laminated cones with rolled P.V.C. surrounds, two 3½" diameter approx. domed tweeters comp with crossover networks

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Here's the mono unit you need to start off with. Gives you a good solid 45 watts rms, 90 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble controls and master volume.

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Sloping facia, you can use the controls without fuss or bother. Brushed alumimium fascia and rotary controls. Five smooth acting, vertically mounted slide controls – master volume, tape level, mic level, deck level, PLUS INTER-DECK FADER for perfect graduated change from record deck No. 1 to No. 2, or vice versa. Pre-fade level control (PFL) lets YOU hear next disc before fading it in. VU meter monitors output level. Output 100 watts RMS 200 watts peak.

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This budget practice amplifier, has been specially designed for the amateur, who requires a quality self-contained unit with all facilities. 2 inputs – 1 for mic or guitar, the 2nd for record player or cassette deck, it also can be used for cine-sound amplification. 2 volume controls, 1 for each input, also base and treble controls. Power output with internal speaker, 10 watts RMS, with remote speaker (not supplied) 20 watts RMS. Size approx. 17" + 9" · 11".

£32^{50}
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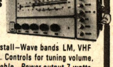
Output 125 Mv

Automatically switches programmes monitored by indicators, with manual override track selection. This unit will match with the Unisound modules and is compatable with the Viscount IV amplifier with Sim teak cabinet. approx. 9" · 8" · 3½". p & p £2.50 £16^{50}

PYE STEREO GRAM CHASSIS

(Complete with circuit-diagrams)



Complete ready to install–Wave bands LM, VHF STEREO, VHF MONO. Controls for tuning volume, balance, bass and treble. Power output 7 watts R.M.S per channel 14 watts peak 8 ohms. 2" · 8" approx chassis speakers and BSR auto record player deck.

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DL96	0·70
DY86/87	0·45
DY802	0·45
E88CC/01	1·30
E180CC	1·30
E182CC	3·50
E810F	6·00
ECF28	0·45
ECF801	0·75
ECH42	0·85
ECH31	0·45
ECH34	0·50
ECL80	0·60
ECL82	0·40
ECL83	1·20
ECL86	0·55
EF36	0·75
EF37A	1·50
EF39	1·00
EF40	0·70
EF41	0·75
EF80	0·35
EF83	1·50
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EBF83	0·45
EBF89	0·40
EC52	0·40
ECC81	0·45
ECC82	0·40
ECC83	0·40
ECC84	0·35
ECC85	0·45
ECC86	1·25
ECC88	0·55
ECC189	0·80
ECF80	0·45
EF92	0·75
EF95	0·45
EF183	0·40
EF184	0·40
EF804	2·00
EFL200	0·75
EH90	0·60
EL32	0·60
EL34	0·80
EL35	0·60
EL37	3·00
EL41	0·30
EL81	0·60
EL82	0·60
EL84	0·35
EL86	0·50
EL90	0·50
EL91	1·60
EL95	0·70
EL504	0·30
EL821	3·00
EM31	0·75
EM80	0·55
EM81	0·60
EM84	0·40
EM87	1·00
EY51	1·00
EY81	0·45
EY86/87	0·50
EY88	0·50
EZ40	0·60
EZ41	0·75
EZ80	0·30
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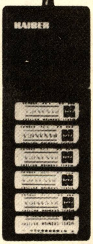

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collection, I met **Vic Elliott** BRS37850 Midhurst, Sussex, who emphasised his delight about the RAE series and explained, that as an ex-RN morse instructor, he is now brushing up his basics for the next exam and plans to become active on the HF bands. Later, I called on **Gordon Goodyer** BRS37345 Petworth, Sussex, a PW reader for many years, who said that he likes the new format but the increase in size upsets his very tidy bookshelves! Gordon spends a lot of time listening on 10m with his CR100 and dipole and on 2m with his home-brew front-ends, indulging in his special interest of making and testing VHF ground plane aerials.

A period of solar activity began on July 23rd and ended on August 5th during which time our extra-terrestrial observers monitored the event. **John Smith,** Cranleigh, Surrey, recorded two definite peaks in the solar noise output at 142MHz, the first started on the 23rd, reached it's peak on the 28th, and returned to normal on August 2 when it rose again to a climax on the 5th and down again by the 10th. In both cases the maximum was about four times the normal level. While the noise was fluctuating, both John and I recorded a host of individual solar bursts, each lasting between one and five minutes, throughout the event. **Cliff Ranft,** Chilworth, Surrey, found evidence of ionospheric disturbance on July 29th and 30th and he recorded a moderate SCNA (Sudden Cosmic Noise, Absorption) between 1410 and 1510 on August 5th.

Although cloudy skies prevented systematic use of the optical instruments, John Smith did manage to see a sunspot group on July 26th, and **Cmdr. Henry Hatfield,** Sevenoaks, using his spectrohelioscope, observed a variety of sunspots between August 1st and 4th, in addition to several small filaments and plages. On August 1st and 2nd Henry saw a bright prominence on the sun's east limb and his records show that each time he sees one of these events we all record some form of radio noise at metre waves. Henry counted five sunspots, plus two plages on the 9th. I received bursts of radio noise at 136MHz on the 10th and on the 13th John Smith noted that the solar noise level was up, and Cliff Ranft again found evidence of an ionospheric disturbance.

According to my observations the cause of the disturbed conditions on the 4th was due to a mixture of tropo, due to the falling pressure noted by both Ciaran and myself, and sporadic-E which manifested itself for most of the morning. At 0913 I received a 599 signal from the 70cm beacon at Sutton Coldfield GB3SUT, a strong picture from Lichfield on Ch. 8 and good signals from ten continental broadcast stations in Band II. At the same time, the influence of sporadic-E ranged from 40 to 73MHz, bringing a host of continental signals into the UK in Band I plus 14 east-European broadcast stations between 66 and 73MHz.

Although the tropo-lift was waning I received 59 signals from F1ENH and G8FAS in Somerset, via the London repeater, GB3LO. Sporadic-E occurred again on the 5th and was most intense at 0910 when I received very strong signals from 46 east-European stations between 66 and 73MHz in addition to sync. pulses on R1, 49·75MHz and a crop of continental stations in Band I.

The falling barometer indicated another tropo opening on August 10 and 11th. At 2300 on the 10th Alan heard a GM station just above the noise on 2m and at 2355 he worked G8JJR near Doncaster on SSB and while he, at the east end of Sussex, listened to a mobile north of Darlington, via the Cambridge repeater, GB3PI. Your scribe, located at the west end of the county, listened to the Bristol Channel repeater GB3BC and it's "Bing-Bong" code, which must be familiar to our GW readers under normal conditions. I am told that the original aerial at the Brighton 70cm repeater GB3BR 433·15MHz has been changed for an improved colinear. G8LGQ who lives to the east of the repeater, with 400ft of chalk in the way, is getting a much better signal than before. Further reports to me or to G8HVV, QTHR.

I received a reasonable signal from GB3SUT from 0050 on the 10th to midday on the 11th, and at 0740 on the 11th I heard the Emley Moor beacon GB3EM 432·910MHz at 559. Slight tropo-lifts produced signals from GB3SUT on 70cm during the early mornings of the 13th and 16th; more reports about 70cm activity would be welcome.

Interest in our microwave reports is growing and a most welcome letter from **Sam Jewell** G4DDK, Stone, Staffs, who says there is some dozen stations active on 10GHz from Birmingham in the south to Manchester in the north and that there is some activity most weeks between various stations in that area. A typical path recently covered was Mow Cop on the Staffordshire-Cheshire border to Winter Hill in Greater Manchester, a line-of-sight distance of 59km. On this occasion G4DDK, G8ANZ and G8BHH were at Mow Cop and G8AXE with G8AFC on Winter Hill.

The type of equipment being used in the Midlands is typical of modern wideband FM gear for 3cm; a 12mW Gunn diode transmitter to a 16in dish and a separate tunable Gunn diode/Sim-2 mixer as receiver with a 106MHz IF, resolved on an FM broadcast receiver. I know just how good this equipment has to be because I spent part of Sunday, August 21st on the Trundle, a hilltop some 675′ ASL, just north of Chichester, Sussex, with Colin Boys G8BCO, Peter Kerry G8ARO and David Bookham G8JNI to see their respective 10GHz stations as they prepared to take part in the RSGB's 10GHz Cumulative contest.

The extreme neatness of each station was impressive. The aerials and the electronics are compact, mounted on sturdy tripods with provision for precise adjustments in both altitude and azimuth. At one time, Colin removed his 18in dish and demonstrated that he could just receive the 10·1GHz beacon GB3IOW St. Catherines, Isle of Wight, on open waveguide proving that he had the full 30dB gain of the dish in hand on that signal. It did not surprise me when I learnt that Colin's microwave gear won him the award at the construction contest organised by the Farnborough and District Radio Society. Peter was using a 12in dish, giving him 24dB gain on his receiver and a 14dB horn on his transmitter. At 1300 a 599 signal from GB3IOW was booming from his receiver and he demonstrated just how critical the direction is; in fact he lost the signal by moving his aerial just 1½in! David's receiver consists of a balanced mixer (pair of 1N23s) into a 40673 mosfet preamp at 100MHz (IF) and then to Mullard modules. His transmitter is a 160mW Gunn diode and his aerial an 18in dish. David also received the beacon signal and a strong signal from G3KSU/P at St Catherines. Each station had two-way contacts with G8BDJ/P Chanctonbury Ring, Sussex and G3IZD/P Lynch Down, Sussex. The climax of their day came at 1800 when G8BCO/P had a 55 contact with GU3JHM/P on Alderney and G8ARO/P had a 59 contact with the Alderney station. Peter told me later that several other UK stations had made it to the Channel Islands on 3cm that afternoon.

The Microwave round table meeting held on August 7th in Winchester was very successful and well-attended in view of the short notice, which goes to show that once again the amateurs are prepared to experiment and pioneer those difficult signal paths. To help them, the 3cm beacon at Alderney GB3ALD is now active and its signals have already been received on the Trundle, a distance of 167km. I understand that several of the microwave boys are planning to get going on 24GHz and I will certainly look forward to receiving their reports for this column.

Reports on the various bands are welcome and should be sent direct, by the 15th of the month, to:-

AMATEUR BANDS Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey KT21 2TW. Logs by bands, each in alphabetical order.

MEDIUM and SW BANDS Charles Molloy G8BUS, 132 Segars Lane, Southport, PR8 3JG. Reports for both bands **must** be kept separate.

VHF BANDS Ron Ham BRS15744, Faraday, Greyfriars, Storrington, Sussex RH20 4HE.

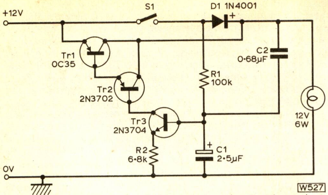

Fig. 6: The final circuit with all the snags ironed out, giving a sharp turn-off to the light, which now remains on for about 15 seconds after the car door is closed.

this is a 30W type so we shouldn't blow it if we use it as the series element. Its gain is given as 25 to 75 at 1A, so let's take a minimum of 20, which means that the base current will need to be 500/20=25mA. If we try to supply all this current from one transistor then the current drawn from C1 will be too high; the easiest way out seems to be to reduce the base current that needs to be supplied, by making the pass element a Darlington pair. The circuit will then look like **Fig. 6**.

The 2N3702 and 2N3704 transistors have been kept since we were using them in our experiments before. Previously the timing period was a bit short but this should go up with increased supply voltage—we can always make C1 bigger if the delay is still too small. R1 has been doubled in value since the supply voltage has been doubled, although this isn't really necessary. D1 can be any diode capable of taking 0·5A with a maximum reverse voltage of about 20V—a 1N4001 should be fine. Silicon types must be preferable here, since we don't want any problems with leakage currents through D1, keeping C1 charged. What value do we need for R2? Well we want 25mA of base current for the OC35 and a catalogue tells us that we can rely on a gain of at least 50 from the 2N3702: this means that the 2N3704 has to supply 500μA, at least until the voltage across C1 is down to 3V or so. A 6·8kΩ resistor should be OK here; it gives a safe limit to the maximum current that Tr3 can supply.

It would be good practice normally to put a resistor from the emitter of Tr2 up to the +12V line. This stops the Darlington pair doing funny things at low currents. However, we're not involved with low currents here so we'll not bother with this resistor.

It is not entirely obvious what effect changing the load will have on the optimum value for C2, so we'll try 0·47μF again and see what happens. We can do this final experimenting when we've built the rest of the circuit on a piece of Blob Board. With the circuit wired up we find that the courtesy light, temporarily excised from the car, stays alight for about fifteen seconds and then turns off. As for C2, the turn-off seems fast and very stable: yet again 0·1μF appears to be not quite enough but 0·47μF, 0·68μF and several larger values that we tried all speed up the switching, with none of that embarrassing flickering that we had before, so let's settle for 0·68μF as the final value for C2. A practical layout is shown in **Fig. 7.**

The output levels and the output impedances of things like cassette recorders don't always match the associated amplifiers so next month's design is for a simple matching circuit.

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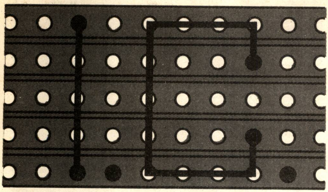

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EA76	1·30
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EC90	·50
EC92	·55
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ECC33	2·00
ECC35	2·00
ECC40	·90
ECC81	·48
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ECC83	·48
ECC84	·35
ECC85	·50
ECC86	1·25
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ECC807	2·80
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ECH81	·55
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ECL80	·45
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ECL83	·74
ECL84	·65
ECL85	·70
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EF41	·75
EF73	1·75
EF80	·29
EF83	1·25
EF85	·36
EF86	·50
EF89	·42
EF91	·70
EF92	·50
EF93	·40
EF94	·40
EF95	·45
EF97	·90
EF98	·90
EF183	·42
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EL34	1·25
EL37	3·00
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EL81	·70
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EL84	·35
EL86	·60
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EL360	1·80
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EM80	·55
EM81	·60
EM83	·60
EM84	·45
EM85	1·20
EM87	1·10
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EY81	·45
EY83	·60
EY86/7	·37
EY88	·55
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EZ35	·45
EZ40	·52
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EZ80	·35
EZ81	·40
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GZ32	·60
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PCC89	·49
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PCF80	·80
PCF82	·45
PCF84	·70
PCF86	·57
PCF200	1·35
PCF201	1·00
PCF801	·49
PCF802	·75
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PL509	2·20
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UCF80	·80
UCH21	2·00
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UCH81	·50
UCL82	·55
UCL83	·57
UF41	·70
UF42	·80
UF80	·40
UF85	·50
UF89	·52
UL41	·70
UL84	·54
UM80	·60
UY41	·50
UY42	·50
UY85	·35
U10	1·00
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AD140	·50
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BC108	·14
BC109	·14
BC113	·30
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BC116	·30
BC118	·26
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BCY34	·26
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BF158	·21
BF159	·30
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BFY52	·23
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BYZ10	·30
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OC71	·13
OC72	·13
OC74	·26
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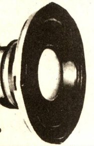
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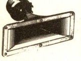

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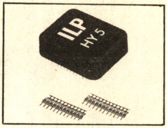
HY5
Preamplifier

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc) are catered for internally. The desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.

FEATURES: Complete pre-amplifier in single pack—Multi-function equalization—Low noise—Low distortion—High overload—Two simply combined for stereo.

APPLICATIONS: Hi-Fi—Mixers—Disco—Guitar and Organ—Public address

SPECIFICATIONS:
INPUTS. Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; input impedance 4·7kΩ at 1kHz.
OUTPUTS. Tape 100mV; Main output 500mV R.M.S.
ACTIVE TONE CONTROLS. Treble ± 12dB at 10kHz; Bass ± at 100Hz.
DISTORTION. 0·1% at 1kHz. Signal/Noise Ratio 68dB.
OVERLOAD. 38dB on Magnetic Pick-up. SUPPLY VOLTAGE ± 16-50V.
Price £5·22 + 65p VAT P&P free.



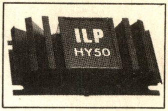
HY30
15 Watts into 8Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of I.C., heatsink, P.C. board. 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up-to-date technology available.

FEATURES: Complete Kit—Low Distortion—Short, Open and Thermal Protection—Easy to Build.

APPLICATIONS: Updating audio equipment—Guitar practice amplifier—Test amplifier—audio oscillator.

SPECIFICATIONS:
OUTPUT POWER 15W R.M.S. into 8Ω: DISTORTION 0·1% at 1·5W.
INPUT SENSITIVITY 500mV. FREQUENCY RESPONSE 10Hz-16kHz—3dB.
SUPPLY VOLTAGE ± 18V.
Price £5·22 + 65p VAT P&P free.



HY50
25 Watts into 8Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: Low Distortion—Integral Heatsink—Only five connections—7 amp output transistors—No external components

APPLICATIONS: Medium Power Hi-Fi systems—Low power disco—Guitar amplifier

SPECIFICATIONS: INPUT SENSITIVITY 500mV
OUTPUT POWER 25W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 25W at 1kHz
SIGNAL/NOISE RATIO 75dB FREQUENCY RESPONSE 10Hz-45kHz—3dB.
SUPPLY VOLTAGE ± 25V SIZE 105 50 25mm
Price £6·82 + 85p VAT P&P free

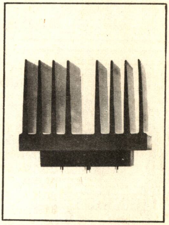
HY120
60 Watts into 8Ω

The HY120 is the baby of I.L.P.'s new high power range. Designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: Very low distortion—Integral heatsink—Load line protection—Thermal protection—Five connections—No external components

APPLICATIONS: Hi-Fi—High quality disco—Public address—Monitor amplifier—Guitar and organ

SPECIFICATIONS
INPUT SENSITIVITY 500mV.
OUTPUT POWER 60W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 60W at 1kHz
SIGNAL/NOISE RATIO 90dB FREQUENCY RESPONSE 10Hz-45kHz – 3dB SUPPLY VOLTAGE ±35V
SIZE 114 50 85mm
Price £15·84 + £1·27 VAT P&P free.



HY200
120 Watts into 8Ω

The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—Integral heatsink—No external components

APPLICATIONS: Hi-Fi—Disco—Monitor—Power slave—Industrial—Public Address

SPECIFICATIONS
INPUT SENSITIVITY 500mV
OUTPUT POWER 120W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·05% at 100W at 1kHz.
SIGNAL/NOISE RATIO 96dB FREQUENCY RESPONSE 10Hz-45kHz – 3dB SUPPLY VOLTAGE ±45V
SIZE 114 50 85mm
Price £23·32 + £1·87 VAT P&P free.

HY400
240 Watts into 4Ω

The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω! It has been designed for high power disco address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

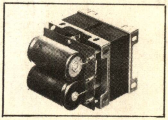
FEATURES: Thermal shutdown—Very low distortion—Load line protection—No external components.

APPLICATIONS: Public address—Disco—Power slave—Industrial

SPECIFICATIONS
OUTPUT POWER 240W RMS into 4Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·1% at 240W at 1kHz
SIGNAL NOISE RATIO 94dB FREQUENCY RESPONSE 10Hz-45kHz – 3dB SUPPLY VOLTAGE ±45V
INPUT SENSITIVITY 500mV SIZE 114 100 85mm
Price £32·17 + £2·57 VAT P&P free.

POWER SUPPLIES

PSU36 suitable for two HY30's **£5·22** plus **65p** VAT. P/P free.
PSU50 suitable for two HY50's **£6·82** plus **85p** VAT. P/P free.
PSU70 suitable for two HY120's **£13·75** plus **£1·10** VAT. P/P free.
PSU90 suitable for one HY200 **£12·65** plus **£1·01** VAT. P/P free.
PSU180 **£23·10 + £1·85** VAT.
B1 **£0·48 + £0·06** VAT.



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71	2	1	**3·41**	0·78
18	4	2	**4·03**	0·96
70	6	3	**5·35**	0·96
108	8	4	**6·98**	1·14
72	10	5	**7·67**	1·14
116	12	6	**8·99**	1·32
17	16	8	**10·39**	1·32
115	20	10	**13·18**	2·08
187	30	15	**17·05**	2·08
226	60	30	**26·82**	OA

50 VOLT RANGE

Prim 220/240V Sec 0-19-25-33-40-50V Voltages available 6, 7, 8, 10, 14, 15, 17, 19, 21, 25, 31, 33, 40, 50V or 25-0-25V

Ref	Amps	£	P & P
102	0·5	**3·41**	0·78
103	1·0	**4·57**	0·96
104	2·0	**6·98**	1·14
105	3·0	**8·45**	1·32
106	4·0	**10·70**	1·50
107	6·0	**14·62**	1·64
118	8·0	**17·05**	2·08
119	10·0	**21·70**	OA

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Ref	VA (Watts)	£	P & P
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149	60	**6·20**	0·96
150	100	**7·13**	1·14
151	200	**11·16**	1·50
152	250	**12·79**	1·84
153	350	**16·28**	2·15
154	500	**19·15**	2·15
155	750	**29·06**	OA
156	1000	**37·20**	OA
157	1500	**45·60**	OA
158	2000	**54·80**	OA
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Prim 220/240V Sec 0-12-15-20-24-30V Voltages available 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V 15-0-15V, 12-0-12

Ref	Amps	£	P & P
112	0·5	**2·64**	0·76
79	1·0	**3·57**	0·96
3	2·0	**5·27**	0·96
20	3·0	**6·20**	1·14
21	4·0	**7·44**	1·14
51	5·0	**8·37**	1·32
117	6·0	**9·92**	1·45
88	8·0	**11·73**	1·64
89	10·0	**13·33**	1·84

60 VOLT RANGE

Prim 220/240V Sec 0-24-30-40-48-60V. Volts available 6,8,10,12,16,18,20,24,30, 36,40,48,60V or 24-0-24V or 30-0-30V.

Ref	Amps	£	P & P
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127	2·0	**7·60**	1·14
125	3·0	**10·54**	1·32
123	4·0	**12·23**	1·84
40	5·0	**13·95**	1·64
120	6·0	**15·66**	1·84
121	8·0	**20·15**	OA
122	10·0	**24·03**	OA
189	12·0	**27·13**	OA

AUTO TRANSFORMERS

Ref	VA (Watts)	Volts	£	P & P
113	20	0-115-210-240	**2·48**	0·71
64	75	0-115-210-240	**3·95**	0·96
4	150	0-115-200-220-240	**5·35**	0·96
66	300	0-115-200-220-240	**7·75**	1·14
67	500	0-115-200-220-240	**10·99**	1·64
84	1000	0-115-200-220-240	**18·76**	2·08
93	1500	0-115-200-220-240	**23·36**	OA
95	2000	0-115-200-220-240	**34·82**	OA
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150	**8·48**	1·14	4W
200	**9·92**	1·45	65W
250	**10·49**	1·45	69W
350	**12·53**	1·64	53W
500	**15·73**	1·64	67W
750	**18·55**	1·76	83W
1000	**22·68**	OA	84W
1500	**26·02**	OA	93W
2000	**37·65**	OA	95W

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	**1·99**	0·55
212	1A, 1A	0-6, 0-6	**2·85**	0·78
13	100	9-0-9	**2·14**	0·38
235	330, 330	0-9, 0-9	**1·99**	0·38
207	500, 500	0-8-9-, 0-8-9	**2·59**	0·71
208	1A, 1A	0-8-9, 0-8-9	**3·53**	0·78
236	200, 200	0-15, 0-15	**1·99**	0·38
214	300, 300	0-20, 0-20	**2·56**	0·78
221	700 (DC)	20-12-0-12-20	**3·41**	0·78
206	1A, 1A	0-15-20-0-15-20	**4·63**	0·96
203	500, 500	0-15-27-0-15-27	**3·99**	0·96
204	1A, 1A	0-15-27-0-15-27	**5·39**	0·96
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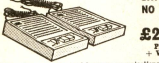

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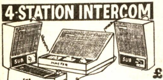

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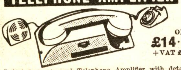

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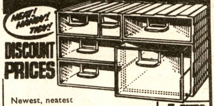
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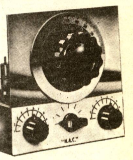

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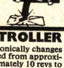
PP3/PP9 REPLACEMENT MAINS UNIT

Japanese made in plastic container with leads size 2" × 1½" × 1½", this is ideal to power a calculator or radio, it has a full wave rectified and smoothed output of 9 volts suitable for a loading of up to 100mA. **£2·53.**

SWITCH TRIGGER MATS



Wiring dig supplied for complete house protection—'Keep Those Robbers Away'.

13 × 10 **£1·85**, 24 × 18 **£2·33**

DRILL CONTROLLER

Electronically changes speed from approximately 10 revs to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **£3·45** including post & VAT. Made up model **£1·00** extra.

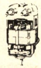
SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450W). Unit in box all ready to work. **£7·95** plus 95p VAT & Postage.

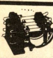
RADIO STETHOSCOPE

Easiest way to fault find, traces, signal from aerial to speaker, when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything. Complete kit comprises two special transistors and all parts including probe tube, twin stetho-set and instructions **£3·95.** VAT and postage incl.

MULTISPEED MOTORS



Six speeds are available 500, 850 and 1,100 r.p.m. and 7,000, 9,000 and 11,000 r.p.m. Shaft is ¼" diameter and approximately 1" long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2" dia. × 5" long. Price **£2·00** including Post & VAT.



MAINS RELAYS

With triple 10 amp changeover contacts—operating coil wound for 230 volts AC, chassis mounting, one screw fixing, ex unused equipment 60p each, 10 for **£5** post and VAT paid.

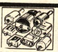
BLACK LIGHT

As used in disco's and stage effects etc.—virtually no white light appear until rays impinge on white collars and cuffs etc—we offer mains B.L. lamps, 175 watts plugs into any lamp holder requires no choke or control gear price **£7·00** + 95p post and VAT or for glamorising rock specimens, looking for watermarks etc. a 9" 6 watt tube with starter, choke lamp holds, etc. all for **£4·50** post and VAT paid.

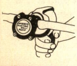
SHORTWAVE CRYSTAL SET

Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19, 25, 29, 31 metre bands. Kit contains chassis front panel and all the parts **£1·90** —crystal earphone **55p** including VAT and postage.

8 POWERFUL BATTERY MOTORS



For models, Meccano's, drills, remote control planes, boats, etc., etc. **£2·00.**



ROTARY PUMP

Self priming, portable, fits drill or electric motor, pumps up to 200 gallons per hour depending upon revs. Virtually uncorrodable, use to suck water, oil, petrol, fertiliser, chemicals, anything liquid. Hose connectors each end. **£2·00** Post Paid.

THERMOSTATS

Room stat.

Refrigeration as illustrated with 36" capillary **£1·62.**

Limpet Stat must be mounted in close contact calibrated 90°-190°F 15 amp contacts **£1·62.**

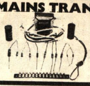
Appliance Stat fix like a volume control—15 amp contact 30°-80°F **85p.**

ditto but for high temps **£1·25.**

Over Stat—with Serson and capillary **85p.**

Wall mounting **£2·75.**

MAINS TRANSISTOR POWER PACK



Designed to operate transistor sets, and amplifiers full wave and half wave working—output adjustable from 45v to 15v up to 300mA—Kit with full constructional data **£2·06**

MULLARD UNILEX

A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost any one in easy-to-assemble modular form and complete with a pair of Plessey speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only **£14·00** including VAT and postage.

AMPLIFIER PANEL

6 photo sockets and d.p. changeover slide switch all mounted on insulating board. Glossy black finish size 2" × 8½" approx.—silly price 35p, or £1 for six.

THIS MONTH'S SNIP

BREAKDOWN PARCEL—

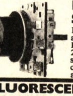
four unused made for computer units containing most useful components, and these components unlike those from most computer panels, have wire ends of easily usable length. The transistors for instance have leads over 1" long, the diodes have approx. ½" leads. List of the major components is as follows: 17 assorted transistors, 38 assorted diodes, 60 assorted resistors and condensers, 4 gold plated plugs in units which can serve as multipin plugs or as hook up boards for experimental or quickly changed circuits (note we can supply the socket boards which were made to receive these units). The price of this four units parcel is £1 including VAT and post (considerably less than value of the transistor or diodes alone). Don't miss this splendid offer.

MAINS TRANSFORMER BARGAINS

20v ½ amp	**£1·25**
18v 1 amp	**£1·55**
6·3v 2 amp	**£1·39**
25v 1½ amp	**£1·75**
24v 2 amp	**£2·00**
50v 2 amp	**£4·50**
9v 1 amp	**£1·25**
8·5v-0-8·5v ½ amp. **£1·25**	
10v, 20v, 30v, 40v	
250 watt loading	**£5·50**
20 watt Auto 115v	**£1·25**
100 watt Auto 115v	**£1·75**

REVOLUTION COUNTER

Famous Muirhead generator: requires only a voltmeter connected to its terminals. Voltage is exactly 3v at 1000 + rpm. Higher or lower speeds give proportional volts, therefore the motor forms the basis of a useful general purpose revolution counter. **£1·25.**



DELAY SWITCH

Mains operated—delay can be accurately set with pointers knob for periods of up to 2½ hrs. 2 contacts suitable to switch 10 amps—second contact opens a few minutes after 1st contact. **95p.**

FLUORESCENT TUBE INVERTOR

For camping—car repairing—emergency lighting from a 12v battery you can't beat fluorescent lighting, it will offer plenty of well distributed light and is economical. We offer Phillips invertor for 12" 8 watt miniature tube for only **£2·75** with tube and tube holders as well.

TERMS:

Cash with order—but orders under **£6** must add 50p to offset packing etc.

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IT'S FREE

Our monthly Advance Advertising Bargains List gives details of bargains arriving or just arrived—often bargains which sell out before our advertisement can appear—it's an interesting list and it's free—just send S.A.E. Below are a few of the Bargains still available from previous lines.

Rigonda "Party Time" Stereo Record Players. A further batch has just arrived, but we have a lot of out-standing orders and so we urge you, if you want one, to call in or post your order right away. As with the first batch all are "returns under guarantee" or "service room rejects", but we guarantee them to be repairable, and will exchange any not so. Price is only **£5·95** + 75p. Carriage £2·00 + 25p, this is of course less than the price of a turntable, so they are a very popular item, hence the urgency for ordering quickly.

Spares for Party Times. Circuit diagrams **50p,** Cartridges **£2·25,** Record mats **85p,** Mains transformers **£3·00,** Amplifiers **£2·50,** Gram motors **£3·00.**

Ask about any other spares you require and when you have it working o.k. we can supply the proper Party Time speakers, **£9·50** a pair. All prices include post and V.A.T.

This Months Special Offer. All our stocks of 7·029 cable with earth wire have now been sold, but we still have some of the twin left—we are offering this at about half its trade price, namely **£8·50** + 72p for 100 metres, also as an extra inducement to buy, during August and September, with every coil we will give free; 100 metres of single 1·5mm which you can use as the earth wire. If not collecting, please add £3·00 carriage.

250 watt Mains Transformer—40v secondary, made up of four 10v sections, all the ends of which are brought out to the tag panel, so they can be separated if required—also the 10v coils are all a very heavy gauge wire, thick enough to take 25 amps, so any one of these coils can be loaded up to the full 250 watts, or this wattage can be spread over two or more coils. We can recommend this transformer for heavy duty battery charging—high power amplifier—plastic sealing—soil heating—light welding and dozens of other jobs. Price, still only **£4·50** + 36p. Post **£1·50** + 12p.

Flex Bargain. 3 core of 14/0·006, modern coloured cores. White circular p.v.c. outer. A standard flex for appliances using up to 6 amps, or for extensions, leads etc. Special purchase enables us to offer this at **£8·50** for 100mm coils (+ 68p). Post £1·50 + 12p.

Save Yourself A Fortune. Build your own rechargeable batteries; using our ex-Home Office nickel cadmium cells—these cells are German made, ref NCB 22M, which we understand are ½ amp hour rating. Normally these cells retail at about **£1·00** each, but a special purchase enables us to offer them at only 30p each, or four for **£1·08.** Post 30p + 3p.

Free Gift: all who purchase 12 cells, will receive, free of charge, a mains operated ni-cad charger unit. DON'T miss this offer . . . . .

Self Repairing Fuses—not exactly; but our magnetic circuit breakers do the same job and are a boon for the test bench, saving valuable time. In the event of a short, they trip almost instantly, before the fuse can blow. They are rated at 1·5 amps (enough for the average repair bench). Simply wire it in parallel with your bench switch—you would then use the circuit breaker to switch bench supply on, but keep your normal switch for loads over 1·5 amps—a real bargain @ **£1·00** + 8p.

9v-0-9v Mains Transformer. "C" core construction, ½ amp continuous rating. Very compact, but there is still room to add a few extra turns for an extra winding, or to change the voltage to, say, 20v. In fact, the transformer uses a separate bobbin for the secondary—its not varnished so if you want a special voltage transformer quickly, then this could be the answer. Price **£1·50** + 12p. Post 20p + 2p.

6·5v-0-6·5v Mains Transformer. Continental make, but has standard 230/40v 50Hz primary and is upright mounting, and is rated at 0·75A. Price **£1·75** + 14p. Post 20p + 2p.

15 Core Flex Cables: Coloured coded cores, rated at 3 amp, with circular p.v.c. outer—suitable for module inter-connections etc. 10 meter coil **£1·00** + 8p.

Rotary Switch. Heavy duty—made for switching d.c., these will make and break really high a.c. currents. We guess these at 30 or more amp—we have type (A) cover engraved on-off. Price **£1·00.**—(B) cover engraved "on", "high", "off", "low". Six wires can be brought to the switch and would be joined as follows: 1 to 5 and 6 to 2 and in the other position, 1 to 3 and 2 to 4. Prices: (A) **£1·00** + 8p. (B) **£1·50** + 12p.

Motor with Fan Blades, mains operated, nicely made motor with long bearing for quiet operation and good quality set of fan blades, made by Smiths (air moving division). It is a simple matter to make a stand out of 14 gauge (clothes line) wire, you then have a simple but efficient desk fan. Or if you fit this behind a heating element, in a box, you have a fan heater. Price of motor and fan, **£2·50** + 32p. Post 50p + 6p.

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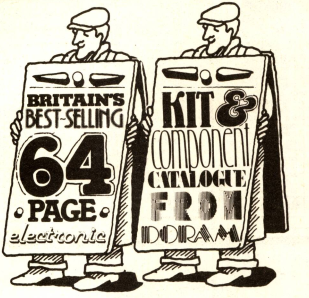

Doram's new catalogue is one of the great events of the electronic year, 64 pages of new ideas in construction kits, capacitors, resistors, semiconductors, wires and cables, transformers, plugs and sockets, hardware, indicators, switches, radio equipment, tools and test equipment, audio equipment, books. All top quality and terrific value because you can depend on Doram.

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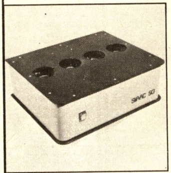
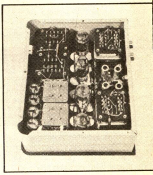
Sirac Mk1 Valve Amplifier

Circuit Diagrams
Outline Drawings
Exploded Views...





all you need to know for constructing Chris Rogers' outstanding new valve amplifier. Then compare the musicality for yourself with a transistor-type unit!

Controversial Comparison

An evaluation of the new crop of moving-coil phono cartridges and their complementary voltage step-up devices. Among those tested are the **Fidelity Research FR 3, Entré I, Sony XL55, Ultimo 10A,** and **Nakamichi 1000,** and 7 others.

Win some Aiwa Super-fi

Another big competition, with the new Autumn range of **Aiwa** equipment to be won.

Listening with Beyer

A special review of the **Beyer** infra-red headphone system.

Amplifiers Examined

This series for the more technically-minded looks this month at the 'Pulse Width Modulation' philosophy. We also test **Cambridge's P80** amplifier – and the new **Meridien** loudspeaker/power amplifier and pre-amplifier.

PRACTICAL HI-FI & AUDIO

November issue
On sale Friday, October 14

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1000 WATT PER CHANNEL.

Three channel: Bass, Middle, Treble.
The input of this unit is connected to the loudspeaker terminals of an amplifier and the required lighting is connected to the output terminals of the unit thus enabling you to produce a fascinating sound to light display.

Full instructions supplied or S.A.E. for details.

Fantastic Value at **£20·00** + 8% VAT.

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(Please state which impedance is required)

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10″ 'ELAC' Dual Cone 8 ohm 10 watt at **£4·75**

EFFECTS PROJECTOR "150" (150 watt)
Ideal for disco work, this versatile machine takes a range of accessories and is of a sturdy metal construction. Comes complete with bulb and 6″ Liquid Wheel. Ready to use.

A bargain at **£34·00** + 8% VAT.

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New High Quality, High Power Tweeter. No Xover required. Freq. Response. 3·8KHz to 28KHz. Spec. Sheet sent on receipt of S.A.E.

OUR PRICE: **£9·35** each + 8% VAT.

POWER SUPPLY UNITS + 8% VAT

PP1—Switched 3, 4½, 6, 7½, 9, 12v at 500m/a with on/off switch and pilot light. Approx size: 130 × 55 × 75mm. ONLY **£6·00.**

PP2—Switched 6, 7½, 9v at 300m/A. This is a sealed, moulded unit fitted with a 3 pin 13A mains plug. Approx. size: 75 × 55 × 45mm. ONLY **£4·00.**

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PP4—Stabilized Power supply. Switched 3, 6, 7½, 9v at 400m/A with on/off switch and pilot light. Approx. size: 115 × 78 × 55mm. ONLY **£7·00.**

PP5—Heavy duty 12 volt power supply. 1·5A at 12 volt. Approx. size: 155 × 90 × 95mm. ONLY **£8·00.**

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240v primary, 12-0-12v 500mA secondary. Approx size: 60 × 40 × 50mm. Fixing centres 75mm. PRICE: **£1·80** + 8% VAT. Also available Mains transformer with 18v 500mA sec. Price and size same as above.

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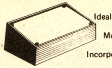


Ideal for small desk control panels and consoles. Moulded in orange, blue, black and grey ABS. Incorporates slots for holding 1.5mm thick pcb's

Aluminium panel sits recessed into front of console and held by screws running into integral brass bushes.

MC 161 x 96 x 58mm	£1.53	(1-9)	£1.50	(10+)
MC 215 x 130 x 75mm	£2.20	(1-9)	£2.17	(10+)

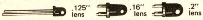
Add 25p per £1 order value for Post & Packing

ECONOMY QUALITY LED's

50 for only £5 – 100 for only £9

Mixed bags, all sizes, various colours

FULL SPECIFICATION LED's



Red (specify size) 75p per pack

Green, Yellow, Orange (specify size) £1.20 per pack

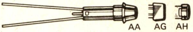
(Each pack contains 5 LED's, Mounting Clips and Data)

TYPE A NEON INDICATORS

Supplied with resistor for 240 Volts operation

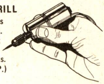
Held in 8mm hole by plastic bezel

150mm wire leads



Red, Amber, Clear, Opal	19p each
Green	28p each

12 VOLTS MINI HAND DRILL



Ideal for drilling pcb, chassis etc as well as model making. Supplied with 2 collets that accept tools and drills with 3/32" and .050" dia. shanks.

£7.56 (Includes VAT & P.P.)

Stop wasting time soldering

The NEW MW BREADBOARD accepts

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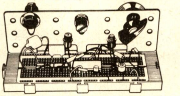

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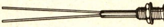
Price £9.72 (includes VAT & P.P.)

TYPE MP NEON INDICATOR

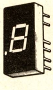
Supplied with resistor for 240 Volts operation

150mm leads, held in 6.4mm hole by nut



Red, Amber, Clear, Opal 20p each

SEVEN SEGMENT DISPLAYS



Economy Quality

Common Anode – 0.3" – Left Decimal

Red, Yellow and Green @ 45p each

Full Specification

Common Anode – 0.3" - Left Decimal

Red @ 98p each

Green and Yellow @ £1.35 each

(Data supplied with Full Spec. displays only)

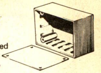
Quantity quotations on request

P.P. Note Unless included in price add 25p Post & Packing for orders totalling under £10. **All** prices include VAT and are valid in UK only for 2 months from journal issue date

Michael Williams Electronics

47 Vicarage Av. Cheadle Hulme, Cheshire SK8 7JP

SC BOXES (square corners)

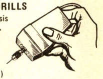


Easily drilled or punched, orange, blue, black and grey ABS. Incorporate slots for holding 1.5mm thick pcb's. Aluminium panel sits recessed into front of the box and held by screws running into integral brass bushes.

SC 85 x 56 x 35mm	80p	(1-9)	77p	(10+)
SC 111 x 71 x 48mm	£1.07	(1-9)	£1.04	(10+)
SC 161 x 96 x 59mm	£1.49	(1-9)	£1.46	(10+)

Add 25p per £1 order value for Post & Packing

240 VOLTS MINI HAND DRILLS

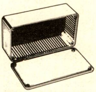


•Ideal for drilling pcb's, chassis etc as well as model making. Supplied with 3 collets that accept tools and drills with 1mm, 2mm and 1/8" dia shanks.

£9.72 (includes VAT & P.P.)

Accessory tools... 5 Burrs, 1mm, 2mm, 1/8th Drills, 3/32" Collet Price £1.75 (Includes VAT & P.P.)

RC BOXES (round corners)



Easily drilled or punched, orange, blue, black and grey ABS. Incorporate slots for holding 1.5mm thick pcb's. Close fitting flanged lids held by screws running into integral brass bushes.

RC 100 x 50 x 25mm	51p	(1-9)	49p	(10+)
RC 112 x 62 x 31mm	59p	(1-9)	52p	(10+)
RC 120 x 65 x 40mm	68p	(1-9)	62p	(10+)
RC 150 x 80 x 50mm	77p	(1-9)	74p	(10+)
RC 190 x 110 x 60mm	£1.33	(1-9)	£1.30	(10+)

Polystyrene version

in grey only with no slots, no integral brass bushes

RC(P) 112 x 61 x 31mm	35p	(1-9)	32p	(10+)

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Slider Switches, 2 pole make and break (or can be used as 1 pole change-over by linking the two centre pins), 4 for **50p.**

Smart Min. Rectangular Push to Make Switches, black rectangular surround with white rectangular button, overall size 12 × 17mm, 3 for **50p**.

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Aluminium Boxes with Lids.

AB10	5¼ × 4 × 1½	**60p**
AB13	6 × 4 × 2	**80p**
AB14	7 × 5 × 2½	**£1·00**
AB15	8 × 6 × 3	**£1·30**
AB16	10 × 7 × 3	**£1·50**
AB17	10 × 4½ × 3	**£1·30**
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Light Blue tops and White lower sections. Very smart fiinish.

WB1	5 × 2½ × 2¼	**60p**
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WB5	11 × 6¼ × 3	**£2·00**
WB6	11 × 7½ × 3½	**£2·25**
WB7	12 × 6¼ × 5¼	**£2·60**
WB853	8 × 5½ × 3½	**£2·00**

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MAINS TRANSFORMERS. Type 60/2, Mains input 200-210-220-230-240-250V a.c., output 0-20-40-60V at 2A, in Metal and Plastic case, approx. 7½ × 4½ × 4, fully fused (ideal for PSU) **£3·00** each.

MAINS TRANSFORMERS. Type 15/300 240V input, 15V at 300mA output, **£1·50** each.

MAINS TRANSFORMERS. Type 45/100, 240, 220, 110, 20, 0V input, 45V at 100mA output, **£1·50** each.

RED LEDs (Min. type) 5 for **70p.**

VIDICON SCAN COILS (Transistor type, but no data) complete with vidicon base **£6·50** each. Brand New.

FULL RANGE OF BERNARDS/BABANI ELECTRONICS BOOKS IN STOCK. S.A.E. FOR LIST.

NEW FOR THE VHF CONSTRUCTOR. A range of tuned circuits on formers with slugs and screening cans. Frequencies quoted are approximate, and range can be greatly extended by using varying capacitors in parallel.

Type S (½in. square, dumpy type).
Type SA 20 to 30MHz (when 33pf fitted in parallel).
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Type SD 135 to 175MHz (with link winding)
Type M (Min. ⅜in. square types).
Type MA 19 to 28MHz (when 33pF fitted in parallel).
Type MB 22 to 32MHz (when 33pF fitted in parallel).
Type MC 25 to 35MHz (when 33pF fitted in parallel).
Type MD 38 to 50MHz (when 33pF fitted in parallel).
Type ME 45 to 60MHz (when 33pF fitted in parallel).
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All the above coils available in packs of five only (same type) at **50p** per pack of 5.

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MULLARD 85A2 85V STABILISER VALVES (Brand New) **70p** each or 2 for **£1·20.**

TO3 transistor insulator sets, 10 for **50p**

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PERSPEX TUNER PANELS (for FM Band 2 tuners) marked 88–108MHz and Channels 0–70, clear numbers, rest blacked out, smart modern appearance, size approx. 8½in × 1¼in., 2 for **35p.**

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SOLDER SUCKERS (Plunger type). Standard Model, **£5**. Skirted Model **£5·50.** Spare Nozzles **60p** each.

WELLER SOLDERING IRONS
EXPERT. Built-in-spotlight illuminates work. Pistol grip with fingertip trigger. High efficiency copper soldering tip.
EXPERT SOLDER GUN 8100D £9·90.
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Spare bits **35p** pair.

NEW MARKSMAN RANGE OF SOLDERING IRONS.
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ALL PRICES + 8% VAT.
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MOST SPARES AVAILABLE.

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Size 5 Savbit 18 s.w.g. in alloy dispenser, **32p** + VAT (3p).
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½ Kg. (1·1lb) 60 × 40, 20 s.w.g. on plastic reel **£3** + VAT (24p).

14 DIL REED RELAYS, 5 to 12V DC, 450 ohm coil.Designed to work directly from TTL Logic, Single Pole Change over. Contact ratings 28V ¼A 3W. **£1·75** each.

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BARGAIN PACK OF LOW VOLTAG ELECTROLYTIC CAPACITORS. Up to 50V working. Seatronic Manufacture. Approx. 10 **£1·50** per pack + 12½% VAT.

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AC176	0·25
AC187	0·25
AC188	0·25
ACY17	0·65
ACY18	0·65
ACY19	0·65
ACY20	0·65
ACY21	0·65
ACY39	1·00
AD149	0·70
AD161	0·75
AD162	0·75
AF106	0·45
AF114	0·25
AF115	0·25
AF116	0·25
AF117	0·25
AF139	0·40
AF186	1·50
AF239	0·45
AFZ11	2·75
AFZ12	2·75
ASY26	0·45
ASY27	0·50
ASZ15	1·25
ASZ16	1·25
ASZ17	1·25
ASZ20	0·75
ASZ21	1·50
AU110	1·70*
AU113	1·70*
AUY10	1·70*
BA145	0·15*
BA148	0·15*
BA154	0·10
BA155	0·12
BA156	0·13
BAW62	0·05
BAX13	0·07
BAX16	0·07
BC107	0·12
BC108	0·12
BC109	0·13
BC113	0·15*
BC114	0·18*
BC115	0·19*
BC116	0·19*
BC117	0·22*
BC118	0·16*
BC125	0·18*
BC126	0·25*
BC135	0·15*
BC136	0·19*
BC137	0·16*
BC147	0·10*
BC148	0·10*
BC149	0·13*
BC157	0·12*
BC158	0·11*
BC159	0·13*
BC167	0·13*
BC170	0·16*
BC171	0·14*
BC172	0·13*
BC173	0·15*
BC177	0·19
BC178	0·18
BC179	0·20
BC182	0·11*
BC183	0·11*
BC184	0·12*
BC212	0·14*
BC213	0·14*
BC214	0·17*
BC237	0·17*
BC238	0·12*
BC301	0·45
BC303	0·60
BC307	0·20*
BC308	0·18*
BC327	0·22*
BC328	0·18*
BC337	0·19*
BC338	0·18*
BCY30	1·00
BCY31	1·00
BCY32	1·00
BCY33	0·90
BCY34	0·90
BCY39	3·00
BCY40	1·25
BCY42	0·30
BCY43	0·32
BCY58	0·23
BCY70	0·18
BCY71	0·22
BCY72	0·17
BCZ11	1·50
BD115	0·60
BD121	1·50
BD123	1·50
BD124	1·00
BD131	0·51
BD132	0·54
BD135	0·35*
BD136	0·36*
BD137	0·37*
BD138	0·40*
BD139	0·43*
BD140	0·47*
BD144	2·00
BD181	1·38
BD182	1·48
BD237	0·80
BD238	0·85
BDX10	0·75
BDX32	2·25
BDY20	1·42
BDY60	0·75
BF115	0·39
BF152	0·25
BF153	0·25
BF154	0·25
BF159	0·35
BF160	0·30
BF167	0·39
BF173	0·39
BF177	0·38
BF178	0·45
BF179	0·48
BF180	0·45
BF181	0·45
BF182	0·45
BF183	0·45
BF184	0·39
BF185	0·37
BF194	0·12*
BF195	0·11*
BF196	0·13*
BF197	0·14*
BF200	0·32
BF224	0·20*
BF244	0·35*
BF257	0·37
BF258	0·42
BF259	0·45
BF336	0·50*
BF337	0·53*
BF338	0·55*
BFS21	2·27
BFS28	1·38
BFS61	0·25*
BFS98	0·25*
BFW10	0·90
BFW11	0·90
BFX84	0·38
BFX85	0·41
BFX87	0·35
BFX88	0·32
BFY50	0·28
BFY51	0·26
BFY52	0·26
BFY64	0·30
BFY90	1·32
BSX19	0·34
BSX20	0·34
BSX21	0·32
BT106	1·25
BTY79/400R	3·19
BU205	2·25*
BU206	2·25*
BU208	2·50*
BY100	0·45
BY126	0·14
BY127	0·15
BZX61 Series	0·20
BZY88 Series	0·13
CRS/105	0·45
CRS/140	0·60
CRS/305	0·45
CRS/340	0·75
CRS/360	0·90
GEX66	1·50
GEX541	1·75
GJ3M	0·75
GJ5M	0·75
GJ7M	0·75
GM0378A	1·50
KS100A	0·40*
MJE340	0·58
MJE370	0·65
MJE371	0·81
MJE520	0·65
MJE521	0·75
MJE2955	1·25
MJE3055	0·75
MPF102	0·30*
MPF103	0·30*
MPF104	0·30*
MPF105	0·30*
MPSA06	0·25*
MPSA56	0·25*
MPSU01	0·32*
MPSU06	0·40*
MPSU56	0·45*
NKT401	2·00
NKT403	1·73
NKT404	1·73
NE555	0·45
OA5	0·75
OA7	0·55
OA10	0·55
OA47	0·14
OA70	0·30
OA79	0·30
OA81	0·30
OA85	0·30
OA90	0·08
OA91	0·08
OA95	0·08
OA200	0·10
OA202	0·11
OA210	0·75
OA211	0·75
OAZ200	0·65
OAZ201	0·65
OAZ206	0·65
OAZ207	0·65
OC16	1·25
OC20	2·00
OC22	2·50
OC23	2·75
OC24	3·50
OC25	0·90
OC26	0·90
OC28	2·00
OC29	2·00
OC35	1·50
OC36	1·50
OC41	0·50
OC42	0·50
OC43	1·50
OC44	0·50
OC45	0·50
OC71	0·45
OC72	0·45
OC73	1·00
OC75	0·50
OC74	0·60
OC76	0·50
OC77	1·20
OC81	0·75
OC81Z	1·00
OC82	0·75
OC83	0·55
OC84	0·60
OC122	1·50
OC123	1·55
OC139	1·25
OC140	1·95
OC141	2·25
OC170	0·60
OC171	0·60
OC200	1·00
OC201	1·50
OC202	1·25
OC203	1·25
OC204	1·25
OC205	1·75
OC206	1·75
OC207	1·25
OCP71	1·25
ORP12	0·70
R200SB	2·25*
R2009	2·25*
R2010B	2·25*
T1C44	0·36
T1C226D	1·30
T1L209	0·25
T1P29A	0·50*
T1P30A	0·60*
T1P31A	0·62
T1P32A	0·75
T1P33A	1·00
T1P34A	1·20
T1P41A	0·70
T1P42A	0·90
T1P2955	1·00
T1P3055	0·50
T1S43	0·35*
ZS140	0·25*
ZS170	0·12*
ZS178	0·54*
ZS271	0·22*
ZS278	0·56*
ZTX107	0·11*
ZTX108	0·10*
ZTX109	0·12*
ZTX300	0·12*
ZTX301	0·13*
ZTX302	0·17*
ZTX303	0·17*
ZTX304	0·19*
ZTX311	0·12*
ZTX314	0·20*
ZTX500	0·13*
ZTX501	0·14*
ZTX502	0·16*
ZTX503	0·17*
ZTX504	0·20*
ZTX531	0·20*
ZTX550	0·16*
1N914	0·07
1N916	0·07
1N4001	0·06
1N4002	0·07
1N4003	0·08
1N4004	0·09
1N4005	0·13
1N4006	0·15
1N4007	0·15
1N4009	0·15
1N4148	0·07
1N5400	0·14
1N5401	0·16
1S44	0·06
1S920	0·08
1S921	0·08
2G301	1·00
2G302	1·00
2G306	1·10
2N404	0·60
2N696	0·25
2N697	0·16
2N698	0·30
2N705	0·80
2N706	0·12
2N708	0·21
2N930	0·26
2N1131	0·26
2N1132	0·26
2N1302	0·37
2N1303	0·37
2N1304	0·45
2N1305	0·45
2N1306	0·50
2N1307	0·50
2N1308	0·60
2N1309	0·60
2N1613	0·33
2N1671	1·50
2N1893	0·33
2N2147	1·40
2N2148	1·65
2N2218	0·33
2N2219	0·42
2N2220	0·35
2N2221	0·22
2N2222	0·25
2N2223	2·75
2N2368	0·17
2N2369A	0·21
2N2484	0·21
2N2646	0·50
2N2904	0·35
2N2905	0·35
2N2906	0·25
2N2907	0·21
2N2924	0·15*
2N2925	0·17*
2N2926	0·13*
2N3053	0·25
2N3054	0·50
2N3055	0·65
2N3440	0·60
2N3441	0·80
2N3442	1·20
2N3525	0·90
2N3614	1·20
2N3702	0·15*
2N3703	0·15*
2N3704	0·15*
2N3705	0·15*
2N3706	0·14*
2N3707	0·18*
2N3708	0·14*
2N3709	0·15*
2N3710	0·14*
2N3711	0·15*
2N3771	1·60
2N3772	1·70
2N3773	2·65
2N3819	0·36*
2N3820	0·46*
2N3823	0·60*
2N3866	1·00
2N3904	0·21*
2N3905	0·22*
2N3906	0·22*
2N4058	0·20*
2N4059	0·15*
2N4060	0·20*
2N4061	0·17*
2N4062	0·18*
2N4124	0·17*
2N4126	0·17*
2N4286	0·20*
2N4288	0·25*
2N4289	0·25*
2N5457	0·35*
2N5458	0·35*
2N5459	0·35*
3N125	1·75
3N141	0·85

VALVES

AZ31	1·10*
CBL31	1·50
CL33	2·00*
CY31	1·00*
DAF91†	0·40*
DAF96	1·00*
DF91†	0·40*
DF96	1·00*
DK91†	0·55*
DK92	1·25*
DK96	1·10*
DL92	0·75*
DL94	1·20*
DL96	1·10*
DY86/7†	0·45*
DY802	0·68*
E88CC†	1·00
EABC80	0·40*
EAC91	0·50
EAF42	1·25*
EAF801	1·75*
EB41	1·75*
EB91†	0·30*
EBC33	1·75*
EBC41	1·25*
EBC81	1·10*
EBC90	0·65
EBF80	0·45*
EBF83	1·25*
EBF89†	0·40*
EBL31	2·50*
ECC40	1·25*
ECC81†	0·45*
ECC82†	0·45*
ECC83†	0·45*
ECC84†	0·50*
ECC85†	0·55*
ECC88†	0·60*
ECC91†	0·35*
ECC189	1·00*
ECF80†	0·60*
ECF82†	0·60*
ECH35	2·00*
ECH42	1·15*
ECH81†	0·50*
ECH83	0·85*
ECH84†	0·85*
ECL80†	0·60*
ECL82†	0·55*
ECL83	1·50*
ECL86†	0·65*
ECLL800	7·00*
EF37A†	1·60*
EF39†	1·60*
EF40	1·15*
EF41	1·20*
EF42	2·00*
EF50†	0·60*
EF80†	0·45*
EF83	1·75*
EF85†	0·50*
EF86†	0·45*
EF89	0·60*
EF91†	0·65*
EF92†	0·75*
EF98	1·25*
EF183†	0·50*
EF184†	0·50*
EH90	0·75*
EL32	1·50*
EL33	3·50*
EL34†	0·85*
EL41	1·25*
EL42	1·75*
EL81	1·10*
EL84†	0·35*
EL86†	0·50*
EL91	3·76*
EL95†	0·80*
EL360	2·25*
EM80	1·10*
EM81	1·00*
EM84	1·00*
EM85	1·25*
EM87	1·50*
EN91†	0·55
EY51†	0·75*
EY86†	0·50*
EZ40	1·25*
EZ41	1·25*
EZ80†	0·30*
EZ81†	0·35*
EZ90†	0·45*
GZ32	0·75*
GZ33	4·00*
GZ34†	1·24*
KT61	3·50*
KT66	4·00*
KT88	4·75*
KTW61	1·75*
KTW62	1·75*
KTW63	1·75*
MU14	1·00*
N78	7·50*
OA2†	0·45
OB2†	0·45
OC3†	0·45
OD3†	0·45
OZ4	0·75*
PC86†	0·85*
PC88†	0·85*
PC97	0·88*
PC900†	0·75*
PCC84†	0·45*
PCC88	0·65*
PCC89†	1·05*
PCC189†	0·65*
PCF80	0·72*
PCF82†	0·50*
PCF86†	0·65*
PCF87†	1·00*
PCF200†	1·05*
PCF201†	1·05*
PCF801†	0·55*
PCF802†	0·72*
PCF805	1·28*
PCF806	0·80*
PCF808	1·28*
PCL82†	0·50*
PCL83†	0·92*
PCL84†	0·50*
PCL85†	0·80*
PCL86†	0·65*
PCL8058/5†	0·80*
PD500	3·00*
PFL200	0·88*
PL36†	0·92*
PL81	0·55*
PL81A†	1·00*
PL82	0·60*
PL83†	0·55*
PL84†	0 60*
PL504/500†	0·96*
PL508†	1·32*
PL509†	2·16*
PL519†	2·96*
PL801	1·10*
PL802†	1·80*
PY33	0·68*
PY81†	0·72*
PY82	0·45*
PY83	0·60*
PY88†	0·68*
PY500A†	1·36*
PY800/81†	0·72*
PY801	0·72*
QQ02-6	9·00
QQV03-10†	1·60
QQV03-20A†	8·50*
QQV06-40A†	8·50*
R17	1·65*
R19	1·00*
R20	1·00*
U18-20	2·50*
U25	1·16*
U26	1·16*
UABC80†	0·50*
UAF42	0·75*
UB41	1·25*
UBC41†	0·75*
UCC84	0·75*
UCC85†	0·50*
UCF80	0·75*
UCH42	1·20*
UCH81†	0·50*
UCL82†	0·50*
UCL83	1·20*
UF41	0·75*
UF80†	0·50*
UF85†	0·50*
UF89†	0·50*
UL41	1·00*
UL84†	0·60*
UM80	1·00*
UY41†	0·75*
UY85†	0·65*
1B3GT†	0·55*
1R5†	0·55*
1S5†	0·40*
1T4†	0·40*
2AS15	10·00
2D21†	0·55
3A5	1·35
3CX100A5	20·00
3S4†	0·75*
3V4†	1·00*
4CX250B	17·50
5R4GY†	1·00*
5U4G	1·00*
5U4GB	1·00*
5V4G†	0·65*
5Y3GT	0·85*
5Z3	1·50*
5Z4G	1·00*
5Z4GT	1·00*
6-30L2	1·00*
6AB7	0·75*
6AC7	0·75*
6AF4A†	0·70*
6AG7	0·75*
6AH6†	0·70*
6AK5†	0·30
6AK6	0·95*
6AL5†	0·30*
6AM4	2·30*
6AM5	3·76*
6AM6†	0·65*
6AN5	2·50*
6AN8A†	0·70*
6AQ5†	0·75*
6AR5	0·70*
6AS6†	0·80*
6AS7G†	1·50*
6AT6†	0·65*
6AU5GT	4·26*
6AU6†	0·55*
6AV5GT	3·74*
6AV6†	0·50*
6AW8A†	1·00
6AX5GT	3·10*
6B7	0·75
6B8	0·75
6BA6†	0·50*
6BA7	5·12*
6BA8A	3·75
6BC4	3·71
6BE6†	0·45*
6BH6†	1·20*
6BJ6†	0·80*
GBK4	4·21*
6BL6	85·00
6BL7GT	3·86*
6BN6	0·80*
6BQ7A	1·55*
6BR7	4·00*
6BR8†	1·20*
6BS7	4·00*
6BW6	3·75*
6BW7	1·12*
6BX7GT	4·96*
6BZ6	1·78*
6C4†	0·40*
6CB6A†	0·50*
6CD6GA	4·00*
6CG7	1·72*
6CH6	4·32*
6CL6†	0·75*
6CW4	4·72*
6D2†	0·30*
6DK6	2·49*
6DQ6B	3·04*
6EA8	2·21*
6EB8	2·12*
6EW6	0·80*
6F6	0·75
6F23	1·32*
6F28	0·96*
6H2N	0·75*
6H3N	0·75*
6H6	0·75*
6J4†	0·75*
6J6†	0·35*
6J7	0·75*
6K4N	0·75*
6K6GT	0·75*
6K7	0·75*
6K8	0·75*
6KD6	4·79*
6L6G	2·50*
6L6GA	1·50*
6L6GT	0·75*
6L6GC	1·75*
6L7	0·75
6N2P	0·75
6N3P	0·75
6N7	0·75*
6P25	3·50*
6Q7	0·75*
6R7	0·75*
6SA7	0·75*
6SC7	0·75*
6SF7	0·75*
6SH7	0·75*
6SJ7	0·75*
6SK7	0·75*
6SL7GT†	0·55*
6SN7GT†	0·55*
6SQ7	0·75*
6SR7	0·75*
6SS7	0·75*
6U5G	2·00*
6U8†	0·40*
6U8A†	0·55*
6V6GT†	0·60*
6X4†	0·45*
6X5GT†	0·55*
7B7	1·00*
7C5	1·75*
7C6	1·25*
7H7	1·00*
7R7	1·50*
7S7	2·25*
7Y4	0·75*
7Z4	0·75*
12AT6	0·45*
12AT7†	0·45*
12AU6	0·50*
12AU7†	0·45*
12AV6	0·60*
12AV7	2·84*
12AX7†	0·45*
12AY7†	0·82*
12B4A†	1·00*
12BA6	0·50*
12BE6	0·60*
12BH7†	0·60*
12BY7†	0·80*
12E1	4·00
30C15	1·20*
30C17	1·20*
30C18	1·28*
30F5	1·00*
30FL1/2	1·00*
30FL12	1·44*
30FL14	1·28*
30L1	0·68*
30L15	1·32*
30L17	1·32*
30P4	0·92*
30P19	0·92*
30PL1	1·32*
30PL13	1·44*
30PL14	1·68*
30PL15	1·44*
35W4	0·60*
50C5	0·70*
85A2	1·50
90AG	7·26
90AV	7·16
90C1	1·50
90CG	5·74
90CV	5·99
92AG	7·26
92AV	7·16
150B2	1·80
150C2	1·50
150C4	2·30
211	5·00
723AB†	8·00
807†	0·65
811A†	3·00
812A	7·25
813†	6·00
833A	25·00
866A	8·85
872A	11·40
931A	12·24
2050	2·50
5642	3·16*
5654	3·53*
5651	1·80*
5670	2·86*
5814A	2·60*
6080†	3·40*
6146A	4·27
6146B	4·65
6159B	6·00
6442	15·00
6973	2·61
7586	6·79
7587	12·54
7868	2·93*
8068	5·50
8136	1·54

INTEGRATED CIRCUITS

7400	0·20
7401	0·20
7402	0·20
7403	0·20
7404	0·26
7405	0·23
7406	0·55
7407	0·55
7408	0·28
7409	0·28
7410	0·20
7412	0·26
7413	0·45
7416	0·40
7417	0·40
7420	0·20
7422	0·25
7423	0·35
7425	0·35
7427	0·35
7428	0·50
7430	0·20
7432	0·36
7433	0·37
7437	0·42
7438	0·37
7440	0·22
7441AN	0·92
7442	0·78
7447AN	1·20
7450	0·20
7451	0·20
7453	0·20
7454	0·20
7460	0·20
7470	0·35
7472	0·36
7473	0·36
7474	0·40
7475	0·59
7476	0·42
7480	0·60
7482	0·85
7483	1·00
7484	1·00
7486	0·40
7490	0·52
7491AN	0·85
7492	0·60
7493	0·70
7494	0·80
7495	0·80
7496	0·90
7497	3·67
74100	1·75
74107	0·45
74109	0·86
74110	0·57
74111	0·86
74116	1·89
74118	0·95
74119	2·00
74120	1·10
74121	0·45
74122	0·60
74123	1·00
74125	0·80
74126	0·80
74128	0·80
74132	0·80
74136	0·68
74141	0·85
74142	3·00
74143	3·00
74144	3·00
74145	1·00
74147	2·45
74148	2·00
74150	1·75
74151	0·90
74154	2·00
74155	0·90
74156	0·90
74157	0·90
74159	2·50
74170	2·60
74172	5·00
74173	1·75
74174	1·57
74175	1·00
74176	1·10
74178	1·65
74179	1·65
74180	1·65
74190	1·48
74191	1·48
74192	1·25
74193	1·25
74194	1·25
74195	1·10
74196	1·20
74197	1·00
74198	2·25
74199	2·25
76013N	1·75*
LM309K	1·50
TAA570	2·30*
TAA630S	3·50*
TBA480Q	1·84*
TBA520Q	2·30*
TBA530	1·98*
TBA540Q	2·30*
TBA550Q	3·22*
TBA560CQ	3·22*
TBA673	2·19*
TBA700	1·52*
TBA720Q	2·30*
TBA750Q	2·07*
TBA990Q	2·99*
TCA270Q	*
TCA760A	1·38*

DIL Sockets

8 PIN	0·15
14 PIN	0·15
16 PIN	0·17

BASES

BG7 unskirted	0·15
B7G skirted	0·30
B9A unskirted	0·15
B9A skirted	0·30
Int Octal	0·20
Mazda Octal	0·20
Nuvistor	0·25
Loctal	0·55
8 pin DIL	0·15
14 pin DIL	0·15
16 pin DIL	0·17
Valve screening cans all sizes	0·30

CRT'S

1CP31	31·00
2AP1*	8·50
2BP1*	9·00
3BP1	6·00
3DP1*	5·00
3EG1*	7·00
3FP7*	3·00
3GP1	6·00
3JP1*	8·00
3JP2*	8·00
3JP7*	10·00
SKP1*	15·00
3RP1*	35·00
4EP1	25·00
4EP7	25·00
4EP11	25·00
5ADP1	35·00
5BP1*	5·00
5CP1*	5·00
5CP1A	40·00
5FP15A	5·00
5FP7*	5·00
5UP7*	5·00
DG7-5	25·00
DG7-32	36·00
DH3-91	31·00
DH7-11	68·00
VCR97*	5·00
VCR138*	10·00
VCR138A*	12·50
VCR139A*	8·00
VCR517A*	3·00
VCR517B*	3·00
VCR517C*	3·00
Tube Bases	0·75

* = Surplus
VAT 8%

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IMPORTANT NOTICE

All schools, colleges, universities and amateur radio and electronic clubs may deduct 10% off pre-VAT prices. Offer valid till 31st October.

SUPER SAVERS

MM5314	3·25
MM5316	3·85
MC1310P	0·95
SG309K	0·95
TIL209	0·10
FCS8000 3½ Digit Disp.	2·95
FCS 8024 4 Digit Disp.	3·50

THYRISTORS

PIV	1A (TO5)	3A (STUD)	3A (C 106)	4A (TO 220)	6A (TO 220)	8A (TO 220)	10A (TO 220)	16A (TO 220)
200	0·35	0·50	0·45	0·40	0·58	0·60	0·68	1·14
400	0·40	0·60	0·50	0·45	0·87	0·88	0·98	1·40
600	0·65	0·85	0·70	—	1·09	1·19	1·26	1·80

BT106 **£1·00**, BT107 **£1·60**, BT108 **£1·60**, BT109 **£1·00**, BT116 **£1·00**, 2N3525 **£0·50.**

TRIACS—Plastic TO-220 Package Isolated Tab

	4A		6·5A		8·5A		10A		15A	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
100V	0·60	0·60	0·70	0·70	0·78	0·78	0·83	0·83	1·01	1·01
200V	0·64	0·64	0·75	0·75	0·87	0·87	0·97	0·01	1·17	1·17
400V	0·77	0·78	0·80	0·83	0·97	1·01	1·13	1·19	1·70	1·74
600V	0·96	0·99	1·01	1·10	1·21	1·26	1·42	1·50	2·11	2·17

N.B.—(a) without internal diac. (b) with internal diac.

NEWS FLASH

Lynx will be holding a seminar this autumn on microprocessors, microcomputers and their applications. There will be a free competition for a system based on Z80. More details next month.

PRICE LIST 20p

TTL7400 Series

7400	0·16
7401	0·16
7402	0·16
7403	0·16
7404	0·18
7405	0·18
7408	0·18
7409	0·18
7410	0·16
7412	0·25
7413	0·40
7414	0·72
7417	0·43
7420	0 16
7425	0·30
7427	0·30
7430	0·16
7432	0 28
7437	0·80
7441AN	0·76
7442	0·65
7445	0·90
7447AN	0·81
7448	0·81
7470	0·32
7472	0·26
7473	0·30
7474	0·32
7475	0·47
7476	0·36
7480	0·55
7482	0·75
7486	0·32
7489	2·02
7490AN	0·49
7491AN	0·65
7492	0·57
7493	0·45
7494	0·85
7495	0·67
7496	0·82
74100	1·07
74107	0·35
74121	0·34
74122	0·47
74123	0·65
74141	0·78
74145	0·68
74154	1·30
/4164	0·93
74165	0·93
74174	1·40
74175	0·94
74180	1·06
74181	2·70
74191	1·33
74192	1·20
74193	1·35
74194	1·20
74196	1·64

Linear I.C.s

301A	0·40*
307	0·55*
380	0·90*
381	1·60*
3900	0·70*
709	0·35
741	0·35
748	0·35
NE555	0·45
NE565	2·00*
NE566	1·50*
NE567	2·00*
CA3045	0·85*
CA3046	0·80*
CA3130	0·90
MC1304P	0·95*
MC1307P	0·85*
MC1310P	1·60*
MC1351P	1·20*
MC1352P	0·75*
MC1353P	0·75
MC1458P	0·77
MC1496L	0·82*
SAS560	2·25
SAS570	2·25
TAA300	1·61
TAA310A	1·38
TAA550	0·45*
TAA611B12	1·25*
TAA861	0·65
TBA530	1·85*
TBA530Q	1·90*
TBA560	2·80*
TBA570	0·98
TCA270SQ	1·95*

Regulators

723	0·45
753	1·50
753	1·50
7805	1·50
7812	1·50
7815	1·50
7818	1·50
309K	0·95
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LM340-12	1·35
LM340-15	1·35
LM340-18	1·35

Displays Class II

704	0·99
707	0·99
727	1·95
728	1·95
747	1·80
750	1·80

L.E.D.

·2 Red	0·13
·2 Green	0·20
·2 Clear	0·10

Clock Chips

MM5314	3·25
MM5316	3·85
AAY-5-1224A	3·25
AAY-5-4007D	9·95

IC Sockets

8 Pin	0·13
14 Pin	0·14
16 Pin	0·15
24 Pin	0·45
40 Pin	0·80

Diodes

BA145	0·14*
BA148	0·13*
BA155	0·13
BA156	0·12
BA157	0·22
BA158	0·22
BA159	0·25
BY206	0·15
BY207	0·20*
BYX36-300	0·12
BYX36-600	0·15

Diodes contd

BYX36-900	0·18
BYX36-1200	0·21
BYX38-300	0·50
BYX38-600	0·55
BYX38-900	0·60
BXY38-1200	0·65
BZX61 Series	0·26
BZX83 Series	0·11
BZY88 Series	0·11
OA5	0·50*
OA10	0·40
OA85	0·12
OA90	0·08
OA91	0·08
OA200	0·09
IN914	0·04*
IN4001	0·04*
IN4002	0·05*
IN4003	0·06*
IN4004	0·07*
IN4005	0·08*
IN4006	0·09*
IN4007	0·10*
IN4148	0·04*

NPN TO-3 Power Transistors. Fully tested but unmarked. Similar to 2N3055 except: BVCEO = 50+ HFE(gain) = 20+ at 3A, VCE SAT < 1·3V at 3A. 5 pcs **£1·00**, 25 pcs **£4·00**, 50 pcs **£7·50**, 100 pcs **£13·00.** **TO-18 NPN Transistors.** Medium Voltage, High Gain unmarked. Similar to BC107/8/9. 25 pcs **£1·20**, 100 pcs **£3·50.** **TO-3 Hardware.** Mica Washers, Solder tag, Nuts, Bolts, 50 sets for **65p.** **Rectifiers DO-4 Package.** 10A 50V **0·45.** 10A 100V **0·50.** 10A 200V **0·60.** 10A 400V **0·75.** Please specify Polarity, Stud Cathode or Stud Anode. Ideal for Power Supplies, Inverters, etc.

Transistors

AC126	0·15
AC127	0·16
AC128	0·16
AC128K	0·25
AC141	0·22
AC141K	0·34
AC142	0·18
AC142K	0·32
AC176	0·16
AC176K	0·32
AC187	0·18
AC187K	0·36
AC188	0·18
AC188K	0·32
AD149	0·80
AD161	0·35
AD162	0·35
AF114	0·20
AF115	0·20
AF116	0·20
AF117	0·20
AF118	0·50
AF124	0·25
AF125	0·25
AF126	0·25
AF139	0·35
AF239	0·37
AL102	1·45
AL103	1·30
AU107	3·30*
AU110	1·75*
AU113	1·60*
BC107	0·12
BC107B	0·12
BC108	0·12
BC108B	0·12
BC109	0·12
BC109B	0·12
BC109C	0·15
BC117	0·19*
BC119	0·25
BC125	0·18*
BC126	0·20*
BC140	0·32
BC141	0·28
BC142	0·23
BC143	0·23
BC147	0·09*
BC148	0·09*
BC149	0·09*
BC157	0·09*
BC158	0·09*
BC159	0·09*
BC160	0·32
BC161	0·38
BC168	0·09*
BC169	0·12*
BC169C	0·14*
BC182	0·11*
BC182L	0·12*
BC183	0·10*
BC183L	0·10*
BC184	0·11*
BC184L	0·12*
BC186	0·20*
BC187	0·24*
BC207B	0·12*
BC212	0·11*
BC212L	0·12*
BC213	0·12*
BC213L	0·14*
BC214	0·14*
BC214L	0·15*
BC237	0·16*
BC238	0·16*
BC300	0·34
BC301	0·32
BC302	0·40
BC303	0·46
BCY30	0·55
BCY31	0·55
BCY32	0·60
BCY33	0·55
BCY34	0·55
BCY38	0·50
BCY39	1·15
BCY40	0·75
BCY42	0·30
BCY54	1·60
BCY70	0·12
BCY71	0·18
BCY72	0·12
BD115	0·55
BD131	0·36
BD132	0·40
BD135	0·36*
BD136	0·39*
BD137	0·40*
BD138	0·48*
BD139	0·58*
BD144	2·20
BD157	0·60
BD181	0·86
BD182	0·92
BD183	0·97
BD184	1·20
BD232	0·60
BD233	0·48
BD237	0·55
BD238	0·60
BD410	0·60
BDX32	2·30
BDY10	1·50
BDY11	2·00
BDY20	0·80
BDY38	0·60
BDY60	1·70
BDY61	1·65
BDY62	1·15
BDY95	2·14
BDY96	4·96
BF179	0·30
BF180	0·30
BF181	0·30
BF182	0·30
BF183	0·30
BF184	0·20
BF185	0·20
BF194	0·10*
BF196	0·12*
BF197	0·12*
BF224J	0·18*
BF244	0·17*
BF257	0·30
BF336	0·35*
BF337	0·32*
BF338	0·45*
BFW30	1·25
BFW59	0·30
BFW60	0·36
BFX29	0·26
BFX30	0·30
BFX845	0·23
BFX8	0·25
BFX86	0·25
BFX87	0·20
BFX88	0·20
BFX89	0·90
BFY11	1·10
BFY18	0·50
BFY40	0·50
BFY41	0·60
BFY50	0·20
BFY51	0·18
BFY52	0·19
BFY53	0·25
BFY64	0·35
BFY90	0·90
BSX19	0·16
BSX20	0·18
BSX21	0·20
BSY52	0·28
BSY53	0·39
BSY54	0·33
BSY55	0·74
BSY65	0·30
BSY76	0·20
BSY78	0·75
BSY95A	0·16
BU105	1·80*
BU105/02	1·90*
BU108	3·00*
BU109	2·50*
BU126	1·60*
BU133	1·60*
BU204	1·60*
BU205	1·90*
BU206	2·40*
BU208	2·60*
MJ480	0·80
MJ481	1·05
MJ490	0·90
MJ491	1·15
MJE340	0·40*
MJE520	0·45
MJE521	0·55
OC43	0·95
OC44	0·32
OC45	0·32
OC46	0·20
OC70	0·30
OC71	0·35
OC72	0·22
OC84	0·40
OC139	1·30
OC140	1·30
OC170	0·23
TIP29A	0·44*
TIP30A	0·52*
TIP41A	0·54
TIP32A	0·64
TIP41A	0·68
TIP42A	0·72
2N404	0·40
2N696	0·20
2N697	0·20
2N706	0·15
2N1131	0·15
2N1132	0·16
2N1302	0·40
2N1303	0·40
2N1304	0·45
2N1305	0·45
2N1306	0·50
2N1307	0·50
2N1308	0·60
2N1309	0·60
2N1711	0·24
2N2102	0·44
2N2217	0·30
2N2369	0·14
2N2369A	0·14
2N2483	0·20
2N2484	0·16
2N2646	0·50
2N2711	0·20
2N2712	0·15
2N2904A	0·20
2N2905	0·18
2N2905A	0·22
2N2906	0·18
2N2925	0·14*
2N2926O	0·09*
2N2926R	0·10*
2N2926Y	0·09*
2N2926G	0·10*
2N3053	0·20
2N3055	0·50
2N3137	1·10
2N3440	0·56
2N3442	1·20
2N3570	3·60
2N3702	0·10*
2N3703	0·10*
2N3704	0 10*
2N3705	0·10*
2N3706	0·10*
2N3707	0·10*
2N3708	0·09*
2N3709	0·09*
2N3710	0·10*
2N3711	0·10*
2N3715	1·70
2N3716	1·80
2N3771	1·60
2N3772	1·90
2N3773	2·10
2N3819	0·28*
2N4347	1·10
2N4348	1·20
2N4870	0·35*
2N4871	0·35*
2N4918	0·60*
2N4919	0·70*
2N4920	0·50*
2N4922	0·58*
2N4923	0·46*

MEMORIES

2102A-6	3·60
2112A-4	4·75
6508	7·95
2102	2·50
2107	10·00
2112	4·50
2513	8·50
2602	2·50

Resistors*

10 OHM-10M

¼ Watt	1·5p
½ Watt	2·0p

CMOS PLASTIC

4000BE	0·20
4001BE	0·20
4002BE	0·20
4006BE	1·05
4007BE	0·20
4008BE	0·93
4009BE	0·52
4010BE	0·52
4011BE	0·20
4012BE	0·20
4013BE	0·50
4014BE	1·00
4015BE	0·95
4016BE	0·54
4017BE	1·00
4018BE	1·10
4019BE	0·50
4020BE	1·12
4021BE	1·03
4022BE	0·95
4023BE	0·20
4024BE	0·86
4025BE	0·20
4026BE	1·55
4027BE	0·62
4028BE	0·91
4029BE	1·10
4030BE	0·55
4041BE	0·80
4042BE	0·83
4034BE	1·00
4044BE	0·94
4046BE	1·32
4049BE	0·54
4050BE	0·54
4069BE	0·30
4070BE	0·50
4071BE	0·26
4072BE	0·26
4081BE	0·20
4082BE	0·26
4510BE	1·42
4511BE	1·50
4516BE	1·35
4518BE	1·25
4520BE	1·20

TV GAMES CHIP

AY-3-8500 **£6·95.** Printed circuit and kit of extra parts:—black and white version **£11·95**, colour model P.O.A. Colour encoder kit converts any black and white TV game to colour **£6·25** Rifle kit **£4·95.** Send sae for free data.

NEW COMPONENT SERVICE

Resistors 5% carbon E12 1 Ω to 10M ¼W **1½p.** 1W **3p. Preset pots** subminiature 0·1W 100 Ω to 4M7 **9p. Potentiometers** ¼W 4K7 to 2M2 log or lin. Single **30p.** Dual **95p. Polystyrene Capacitors** E12 63V 22pf to 8200pf **3½p. Ceramic Capacitors** 50V E6 22pf to 47000pf **3p. Polyester capacitors** 160V E6 ·01 to ·1mf **5½p.** ·15, ·22, ·33mf **7p.** ·47mf **11p. Electrolytics 50V** ·47, 1, 2mf **5p. 25V** 5, 10mf **5p. 16V** 22, 33, 47mf **6p.** 100mf **7p.** 220, 330mf **9p.** 470mf **11p.** 1000mf **18p. Zener Diodes** 400mW E24 3V3 to 33V **8½p.**

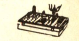
MAINS TRANSFORMERS

6-0-6V 100mA **94p** 9-0-9V 75mA **94p.** 0/12/15/20/24/30V 1A **£3·85.** 12-0-12V 50mA **94p.** 0/12/15/20/24/30V 2A **£5·15.** 6·3V 1½A **£2·30.** 6-0-6V 1½A **£2·75.** 9-0-9V 1A **£2·39.** 12-0-12V 1A **£2·69.** 15-0-15V 1A **£2·89.** 30-0-30V 1A **£3·59.**

PRINTED CIRCUIT KITS, ETC.*

Contains etching dish, 100 sq ins of pc board, 1lb ferric chloride, etch resist pen, drill bit and laminate cutter **£3·95.** 100 sq ins pc board **80p.** 1lb FeCl **£1·05.** Etch resist pen **75p.**

S-DECS AND T-DECS*



S-DeC **£1·94.** T-DeC **£3·61.**
u-DeCA **£3·97.** u-DeCB **£6·67.**
IC carriers with sockets:
16 dil **£1·91.** 10T05 **£1·79.**

SINCLAIR CALCULATORS

Cambridge Scientific Programmable **£13·95.** Prog. library **£4·95.** Cambridge Scientific **£8·45.** Oxford Scientific **£10·60.** Mains adaptors **£3·20.**

BATTERY ELIMINATOR BARGAINS

TV GAMES POWER UNIT

Stabilised 8½V 100mA **£3·20**

3-WAY MODELS

With switched output and 4-way multi-jack connector. Type 1:—3/4½/6V at 100mA **£2·30.** Type 2:—6/7½/9V 300mA **£2·99.**

100MA RADIO MODELS

With press-stud connectors. 9V **£3·45.** 6V **£3·45.** 9V + 9V **£5·15.** 6V + 6V **£5·15.** 4½V + 4½V **£5·15.**

CASSETTE MAINS UNIT

7½V with 5 pin din plug 150mA **£3·65.**

FULLY STABILIZED MODEL £6·40.

Switched output of 3/6/7½/9V 400mA stabilized.

CAR CONVERTORS 12V INPUT

Output 9V 300mA **£1·80.** Output 7½V 300mA **£1·80.**

BATTERY ELIMINATOR KITS

Send s.a.e. for free leaflet on range.

100mA radio types with press stud battery terminals. 4½V **£2·10.** 6V **£2·10.** 9V **£2·10.** 4½V+4½V **£2·50.** 6V+6V **£2·50.** 9V+9V **£2·50.**

Cassette type 7½V 100mA with din plug **£2·10.**

Transistor stabilized 8-way type for low hum. 3/4½/6/7½/9/12/15/18V. 100mA **£3·20.** 1Amp **£6·40.**

Heavy duty 13-way types 4½/6/7/8½/11/13/14/17/21/25/28/34/42V. 1 Amp **£4·85.** 2 Amp **£7·95.**

Car convertor kit Input 12V DC. Output 6/7½/9V DC 1A transistor stabilized **£1·95.**

Stabilized Laboratory power kit Switched 1 to 30V in 0·1V steps. 1 Amp **£12·45.** 2 Amp **£14·95.**

BI-PAK AUDIO MODULES

S450 tuner **£21·95.** AL60 **£4·86.** PA100 **£14·95.** MK60 audio kit **£36·45.** Stereo 30 **£17·95.** SPM80 **£3·75.** BMT80 **£4·25.** Send sae for free data.

SINCLAIR IC20

IC20 10W+10W stereo integrated circuit amp kit with printed circuit and data **£6·95.**
PZ20 Power supply kit for above **£3·65**
VP20 Volume, tone control and preamp kit **£8·95.**
Send sae for free leaflet on the whole system.

JC12 AND JC40 AMPLIFIERS

JC12 6W IC audio amp with free data and printed circuit **£1·95.** Also new JC40 20W model with pcb **£3·95.** Send sae for free leaflet on both models and associated power supply and preamp kits.

FERRANTI ZN414

IC radio chip **£1·44.** Extra parts and pcb for radio **£3·85.** Case £1. Send sae for free data.

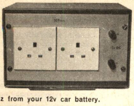
SWANLEY ELECTRONICS

DEPT. PW, PO BOX 68,
32 GOLDSEL RD., SWANLEY, KENT

Post 30p. Prices include VAT. Official orders welcome. Overseas customers deduct 7% on items marked * and 11% on others.

INVERTORS

KIT FORM or BUILT UP.



240v-50Hz from your 12v car battery.

O/P Powers available. 25W–40W–75W–150W–300W–400W–500W–1kW–1·5kW. Various battery I/P voltages available.

AUTOMATIC INVERTORS

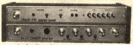
These units have built-in battery charger which functions whilst mains are healthy. Upon mains failure unit automatically switches to invertor operation ensuring no interuption of supply. Send S.A.E. for price lists.

RHYTHM GENERATOR

15 different rhythms, 9 percussion instruments. Tempo range 15 to 100 bars/min. Full kit of parts available at **£39·50** + £1·20 P. & P. + VAT at 8%. Price assembled and tested add **£12.** Parts available separately, send S.A.E.

We reserve the right to alter published prices in the event of component or postal increases.

P.E. ORION STEREO AMPLIFIER & TUNER



May be mounted slim line or stacked as above. Parts available separately for both units.

20 + 20 Watts r.m.s. into 8 ohm load. Distortion less than 0·1% 100Hz–10kHz. Frequency response ± 1dB 20 Hz to 20kHz. Hum level virtually nil with volume full on. This is a power amplifier of superb quality incorporating the very latest design features. Professional hi-fi enthusiasts have classed it as fantastic and real value for money. The CCT incorporates a low flux transformer and inputs for disc, tape, tuner, etc.

TUNER UNIT

May be purchased separately in matching slim line case. As full kit or individual parts.

Send S.A.E. for price list and specification sheets.

LOUDSPEAKERS

8 inch system

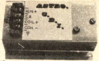
This system is designed for use with above amplifiers rated up to 25W r.m.s. per channel at 8 Ω. May be incorporated in an enclosure 295 x 490 x 295mm (11·5 x 19·3 x 11·5in) approx. external, constructional details of which are given with each bass unit, to provide an overall frequency response of **50Hz to 22kHz.** Four-element cross-over, ready constructed on p.c.b. Output leads have push-on receptacles to suit speaker tags. Cross-over frequency is 2·8kHz approx.

POWER UNIT

Regulated

Voltage adjustable from 1–35v at 2 amps. Short circuit protected. Voltage and current meters incorporated. Full Kit of parts **£48** + 8% VAT or assembled and tested **£58** + 8% VAT.

ASTRO IGNITION



SAVE FUEL

Complete kit of parts for this proven and tested system. (**£11·90** + 60p P. & P.) + 8% VAT or ready built with only two connections to alter.

(**£14·90** + 60p P. & P.) + 8% VAT.

Consider the advantages:

Fuel economy. Faster acceleration. More power. Excellent cold starting. Smoother running. No contact breaker burning. Less exhaust gases.

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SPECIAL OFFER

Miniature Mains Trans.
6–0–6v–6VA.
12–0–12v–6VA.
(**£1·29** + 25p P. & P.) + 8% VAT

Transformer and coils manufactured to customer specifications both in High Volume and Small Order capacity.

TRADE AND EXPORT ENQUIRIES WELCOMED ON ALL PRODUCTS:

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Chesterfield (31475)
Derbyshire

N.B.—DELIVERIES ON ALL ITEMS MAY TAKE UP TO 28 DAYS. DEPENDING ON AVAILABILITY AND DEMAND. CASH IN REGISTERED ENVELOPE OR POSTAL ORDERS CAN REDUCE TIME by NOT HAVING TO CLEAR CHEQUES

PRACTICAL WIRELESS T.V. SOUND TUNER

(Nov. 75 article by A. C. Ainslie) *Copy of original article supplied on request*

IF Sub-Assembly (G8) **£6·80.** P & P 75p
Mullard ELC1043 V'cap UHF Tuner **£4·50.** P & P35p.
3-way Station Control Unit **£1·20.** P & P 25p.
6-way Station Control Unit (Special Offer) **£1·00.**
Power Supply Prtd Circuit Board **£1·00.** P & P 30p.
Res, Caps, Semiconds, etc. for above **£5·80**
Mains Transformer for above **£2·50.** P & P 30p

Add 12½% VAT to price of goods. P & P all items 85p.

Callers welcome at shop premises.

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Single stage stereo preamp boards Max 1/P 700Mv (high z) gain 26 d.b. new. **40p**
Grundig Electret microphone inserts with F.E.T. preamp **£1·50.**
12 volt Amp. Boards with TBA810 I.C., 2 × 1000 M.F.D. caps etc., new **70p.**
A.M./F.M. 7 trans. tuner board with Var. cap., 5 way push button unit 10·7 Mhz filter, I.F.T.'s, etc., suitable for spares **75p.**
Model motors 1·5–6v d.c. **20p**, 12 v d.c. 5 pole **40p.**
Low rev. motors—240v a.c. 1/24th r.p.m. **65p**, $^1/_5$th r.p.m. **65p** 115v a.c. miniature motor with gearbox, 3 r.p.m. **30p.**
Plastic project boxes A.B.S. black with lid, 75 × 56 × 35mm **40p.** 95 × 71 × 35 mm **49p.** 115 × 95 × 37 mm **57p.**
Grey potting boxes A.B.S. with lugs 23 × 48 × 23 mm **11p.** 38 × 52 × 25 mm **13p.** 100 × 80 × 42 mm **28p.**
G.P.O. board with 64 BC107 (type) trans. 2 reed and one mercury relay, diodes etc. **£2·00** + 55p p & p.
500 m reels 2 core single strand wire **£4·00** + 85p p & p.
SAVBIT 500 gram cored solder per reel **£2·50** + 35p p & p.
465 kz I.F. panels 6 IF.T.'s 3 trans. etc. **30p.**
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Stereo preamp chassis with controls ceramic input with circuit **£3·50.**
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G.P.O. buzzers 6-12v d.c. **30p.** 6-12v hooters **50p.**
Miniature solid state buzzers 6, 9, 12, or 24v 15 M/a **75p.**
Omron 12v a.c. relays 11 pin series 3 c/o 5 amp **80p.**
Miniature 220v a.c. sealed relay 2 pole c/o **40p**
12v d.c. sealed relay 3 pole n/o, 1 pole n/c, 1 pole c/o, 2 amp contacts 130Ω coil **65p.**
12v reed relay 4 make **20p.**
6Mh 3 amp smoothing chokes **30p.**
Veeder root reset. 3 digit 240v a.c. counters **£1·95.**
Single digit electro mech. counter 24v d.c.
100-0-100μa level meters **75p.**
Stereo tuning meters 100μa per movement **£2·75.**
Level meter 20mm × 10 mm 10 m/A **40p.**
Smiths 270° 5mA, meters 115mm diam. scaled in tons **£1·50.**
Ferranti 250-0-250 aμ panel meter (scaled 150-0-150) 80 × 75 mm **£3·50.**
Mains transformers 240v a.c. primary A 6-0-6v 100 m/a **75p.** 9-0-9v 75 m/a **75p.** 12-0-12v 50 m/a **75p.** 12v 500 m/a **95p.** 15-0-15v 1 amp **£2·00** + 35p p & p. 0-12-15-20-24-30 2 amps **£4·95** & 35p p & p. 2·5v 2 amp **£1·75** + 35p p & p. 35v 2 amp + 2·5v 2 amp Toroid. **£2·75** + 35p p & p.
18v 1 amp rectified **£1·95** + 35p p & p. 18v 1·5 amp + 12V 1 amp **£2·20** + 35p p & p.
20v 2·5 amp **£2·20** + 35p p & p. 80 watt auto tapped 240-135-115-110v a.c. **£1·95** + 35p p & p.
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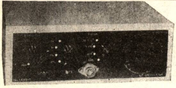

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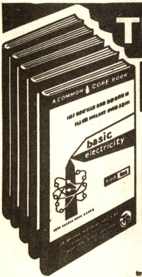

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160V: 0·039, 0·15, 0·22 **11p**; 0·33, 0·47 **19p**; 0·68, 1·0 **22p**; 1·5 **29p**; 2·2 **32p**; 4·7 **36p**.
DUBILIER: 1000V: 0·01, 0·015 **16p**; 0·022 **18p**; 0·047 **16p**; 0·1 **34p**; 0·47 **43p**.

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0·01, 0·015 **6p**; 0·022, 0·027 **7p**; 0·033, 0·047, 0·068, 0·1 **8p**; 0·15 **12p**; 0·22, 0·33 **14p**; 0·47 **16p**; 0·68 **20p**; 1·0 **24p**; 1·5 **27p**; 2·2 **31p**.

FEED THROUGH CAPACITORS
1000pF/350V **8p**

ELECTRONIC CAPACITORS: Axial lead type (Values are in μF).
63V: 0·47, 1·0, 1·5, 2·2, 2·5, 3·3, 4·7, 6·8, 8, 10, 15, 22, **9p**; 47, 32, 50, **12p**; 63, 100, **27p**; **50V:** 1·0, **7p**; 50, 100, 220, **25p**; 470, **50p**; 1000, **62p**; 2200, **68p**; **40V:** 22, 33μF, **9p**; 100, **12p**; 3300, **62p**; 4700, **64p**; **35V:** 10, 33, **7p**; 330, 470, **32p**; 1000, **49p**; **25V:** 10, 22, 47, **6p**; 80, 100, 160, **8p**; 220, 250, **13p**; 470, 640, **25p**; 1000, **27p**; 1500, **30p**; 2200, **34p**; 3300, **52p**; 4700, **54p**; **16V:** 10, 40, 47, 68, **7p**; 100, 125, **8p**; 470, **16p**; 1000, 1500, **20p**; 2200, **34p**; **10V:** 4, 100, **6p**; 640, **10p**; 1000, **14p**.
TAG-END TYPE: 70V: 2000, **98p**; 4700, **121p**; **50V:** 3000 75p; **40V:** 2500, **65p**; **25V:** 4700, **48p**; 2000, **37p**; **40V:** 2000+2000, **95p**; **350V:** 32+32, **185p**.

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35V: 0·1μF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2μF, 3·3, 4·7, 6·8. **25V:** 1·5, 10. **20V:** 1·5μF **13p** each. **10V:** 22μF, 33, **6V:** 22μF, 47, 68, **3V:** 100μF **20p** each.

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0·015, 0·02, 0·03, 0·04, 0·05, 0·056μF **6p**
0·1μF, 0·15, 0·2 7p. **50V:** 0·47μF **10p**

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Range: 0·5pF to 10nF **3p**
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6:1/36:1 **520p**
Drum 54mm **30p***
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00 2 365pF **275p**
0 2 365pF with slow motion Drive **305p**
00 208/176 **285p**
,, ,, with slow motion drive **305p**
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100, 150pF **195p***
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00-3x25pF **386p**

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1000, 2200pF **20p** each.

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100–500pF 1250pF **38p**

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1W	2·2Ω-10M	E12	5p	4p
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TO5 **9p**
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TO88 **22p**
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0-6 0-6V 280mA **150p**
12-0-12V 0·5A **240p+**
0-12 0-12 0·5A **240p+**
15-0-15V 0·5A **220p+**
20-0-20V 6VA **220p+**
24-0-24V 0·5A **260p+**
9-0-9V 1A **245p+**
0-12 0-12V 1A **245p+**
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30-24-20-15-12-0 2A multi tap **445p+**
15-0-15V 1A **245p+**
18-0-18V 1A **275p+**
30-0-30V 1A **295p+**
20-0-20 2A **320p+**
6-0-6V 1·5A **345p+**
0-18 0-18V 1·5A **379p+**
9-0-9V 2A **270p+**
12-0-12V 2A **320p+**
30-25-20-0-20-25-30 2A **497p+**
LT44 **54p**
0-6 0-6V 6VA **240p**
0-12 0-12A 6VA **240p**
0-15 0-15V 6VA **240p**
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AC125*	22
AC126*	18
AC127*	18
AC128*	18
AC141*	24
AC141K*	38
AC142*	24
AC142K*	38
AC176*	18
AC187*	18
AC188*	18
ACY17	35
ACY18	35
ACY19	35
ACY20	35
ACY21	35
ACY22	35
ACY28	35
ACY39	78
ACY40	45
ACY41	39
ACY44	39
AD149*	60
AD161*	40
AD162*	40
AF114*	20
AF115*	20
AF116*	20
AF117*	22
AF118*	55
AF121*	48
AF124*	35
AF125*	35
AF127*	35
AF139*	40
AF178*	70
AF180*	70
AF186*	50
AF239*	39
ASY26*	45
ASY27*	45
ASY50	95
ASY76	95
ASZ21	60
BC107*	9
BC107B*	10
BC108*	9
BC108B*	12
BC108C*	12
BC109	9
BC109B*	12
BC109C*	12
BC113	17
BC114	20
BC115	20
BC116	20
BC117	20
BC118	16
BC119*	28
BC134	20
BC135	14
BC136	18
BC137	15
BC140*	38
BC142*	28
BC143*	28
BC147	7
BC148	7
BC149	8
BC153	27
BC154	27
BC157	11
BC158	11
BC159	11
BC160*	42
BC167A	12
BC168C	12
BC169C	14

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BC170	15
BC171	11
BC172	10
BC177*	18
BC178*	16
BC179*	18
BC182	10
BC183	11
BC184	12
BC182L	13
BC183L	12
BC184L	14
BC186	24
BC187*	28
BC212	12
BC212L	13
BC213	11
BC213L	14
BC214	15
BC214L	16
BC307B	20
BC308	20
BC328	20
BC338	20
BC441*	40
BC461*	40
BC462*	40
BC547	24
BC548	24
BC549C	24
BC557	30
BC559	32
BCY30*	57
BCY34*	80
BCY39*	80
BCY40*	90
BCY42	85
BCY43	85
BCY58	90
BCY59*	19
BCY70*	17
BCY71*	20
BCY72	17
BCY78	28
BCZ10	145
BCZ11	145
BCZ106A	245
BD112	95
BD115*	62
BD124*	110
BD131*	38
BD132*	40
BD133*	60
BD135	45
BD136	44
BD137	42
BD138	50
BD139	52
BD140	57
BD142	59
BD144*	160
BD145*	55
BD181	130
BD205	110
BD434	42
BD378*	65
BD517*	65
BDY11	250
BDY17*	195
BDY60*	128
BDY61*	147
BF115*	22
BF154*	22
BF156*	29
BF160	27
BF161	60
BF167	60
BF173*	25
BF177*	26
BF178*	28

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BF179*	33
BF180*	33
BF181*	33
BF182*	33
BF183*	33
BF184*	28
BF195*	30
BF194	10
BF195	10
BF196	14
BF197	15
BF198	15
BF199	18
BF200	37
BF224A	15
BF244B	34
BF256*	34
BF257*	34
BF258*	38
BF259*	38
BF594	30
BF595	28
BFR39	25
BFR40	25
BFR79	25
BFR80	25
BFX29*	28
BFX81*	141
BFX84*	24
BFX85*	28
BFX86*	28
BFX87*	23
BFX88*	26
BFY18*	50
BFY50*	17
BFY51*	17
BFY52*	17
BFY53*	28
BFY55*	45
BFY64*	40
BFY65*	25
BFY71*	20
BSX20*	20
BSX26*	75
BSX29*	45
BSX78*	55
BSY78*	25
BSY95A	18
BU105*	168
BU205	220
BU208	250
MD8001	158
ME1120	25
ME4102	15
MJ400*	90
MJ491*	160
MJ2955*	120
MJE340*	45
MJE370*	68
MJE371*	80
MJE520*	65
MJE521*	74
MJE2955*	98
MJE3055*	62
MPF102	36
MPF103	36
MPF104	36
MPF105	36
MPF106	50
MPF107	50
MPS3904	20
MPSA05	32
MPSA06	32
MPSA55	30
MPSA56	30
MPSA70	34
MPSU02	5P
MPSU05	64
MPSU06	64
MPSU52	65
MPSU55	82

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MPSU56	82
MPU131*	39
OC23*	65
OC25*	65
OC26*	95
OC28*	70
OC29*	70
OC35*	70
OC36*	70
OC41*	17
OC42*	17
OC43*	25
OC44*	25
OC46*	35
OC70*	25
OC71*	23
OC72*	27
OC74*	45
OC75*	45
OC76*	45
OC77*	56
OC79*	58
OC81D*	28
OC82D*	35
OC83*	28
OC84*	44
OC122*	99
OC123*	115
OC139*	140
OC140*	125
OC141*	157
OC170*	40
OC171*	42
OC200*	125
OC201*	125
OC203*	150
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SJE5039*	95
TIC44*	25
TIC45*	45
TIP29	43
TIP29A	44
TIP29B	56
TIP29C	68
TIP30	52
TIP30A	56
TIP30B	64
TIP30C	74
TIP31*	52
TIP31A*	54
TIP31B*	58
TIP31C*	68
TIP32*	60
TIP32A*	63
TIP32B*	80
TIP32C*	83
TIP33*	95
TIP33A*	95
TIP33B*	112
TIP33C*	120
TIP34*	110
TIP34A*	115
TIP34B*	140
TIP34C*	180
TIP35*	219
TIP35A*	219
TIP35B*	240
TIP35C*	270
TIP36*	320
TIP36A*	346
TIP36B*	352
TIP36C*	360
TIP41A*	66
TIP41B*	73
TIP42A*	78
TIP42B*	82
TIP2955*	69
TIP3055*	56
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TIS44	27
TIS45	37

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TIS46	40
TIS47	50
TIS48	50
TIS49	50
TIS50	47
TIS74	47
TIS90	24
TIS91	24
ZTX107	12
ZTX108	10
ZTX109	15
ZTX212	18
ZTX300	14
ZTX301	14
ZTX302	19
ZTX303	22
ZTX304	24
ZTX311	15
ZTX314	24
ZTX320	26
ZTX326	26
ZTX341	20
ZTX500	17
ZTX501	15
ZTX502	19
ZTX503	19
ZTX504	51
ZTX531	28
ZTX550	18
40250	85
40251	97
40311*	42
40313*	114
40315	55
40316*	69
40317*	42
40319	85
40320	85
40323	85
40324	85
40326*	42
40327*	48
40347*	65
40348*	83
40360*	36
40361*	36
40362*	43
40377	140
40406	65
40407	50
40408	75
40411*	295
40412*	42
40430*	99
40476	170
40594*	90
40495*	98
40603*	62
40636*	110
40673*	74
2N697*	21
2N698*	39
2N699*	45
2N706A*	19
2N707*	50
2N708*	19
2N914*	18
2N916*	27
2N918*	34
2N920*	51
2N930*	18
2N961*	61
2N1131*	19
2N1132*	25
2N1303*	27
2N1304*	45
2N1305*	32
2N1306*	37
2N1307*	37
2N1308*	48

2N1613*
2N1670*
2N1671B*
2N2160*
2N2217*
2N2218A*
2N2219A*
2N2220A*
2N2221A
2N2222A*
2N2303*
2N2368
2N2369A*
2N2483*
2N2484*
2N2614
2N2646*
2N2904*
2N2905A*
2N2906*
2N2907*
2N2907A*
2N2926G
2N3011*
2N3053*
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2N4037*
2N4058
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2N5458
2N5459
2N5485
2N5777
2N6027
2N6109
3N128
3N140
Matched Pair 10p extra

TTL 74*

7400	14
7401	14
7402	16
7403	16
7404	20
7405	22
7406	44
7407	44
7408	22
7409	22
7410	15
7411	25
7412	25
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7414	74
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7417	39
7420	16
7421	29
7422	24
7423	30
7425	30
7426	36
7427	36
7428	48
7430	18
7432	28
7433	48
7437	30
7438	33
7440	17
7441	74
7442	74
7443	130
7444	122
7445	94
7446	116
7447	82
7448	80
7450	17
7451	17
7453	17
7454	17
7460	17
7470	32
7472	28
7473	32
7474	36
7475	36

7476	36
7480	50
7481	114
7482	82
7483	95
7484	95
7485	125
7486	36
7489	390
7490	43
7491	80
7492	53
7493	40
7494	85
7495	73
7496	82
7497	262
74100	135
74104	48
74105	48
74107	33
74109	64
74110	54
74111	76
74116	198
74118	115
74120	105
74121	34
74122	50
74123	73
74125	69
74126	65
74128	81
74132	75
74141	72
74142	315
74143	314
74144	314
74145	90
74147	275
74148	160
74150	128
74151	79
74153	82
74154	150
74155	76
74156	80
74157	95
74159	225
74160	116

74161	116
74162	116
74163	116
74164	121
74165	120
74166	161
74167	362
74172	590
74173	175
74174	173
74175	90
74176	120
74177	116
74180	106
74181	299
74182	85
74184	184
74185	146
74188	650
74190	194
74191	165
74192	120
74193	120
74194	120
74195	95
74196	118
74197	118
74198	248

CMOS* (RCA)

4000	15
4001	17
4002	17
4006	115
4007	18
4008	97
4009	60
4010	60
4011	19
4012	18
4013	55
4014	104
4015	99
4016	55
4017	104
4018	105
4019	60
4020	125
4021	105
4022	95
4023	20

4024	85
4025	19
4026	185
4027	60
4028	95
4029	109
4030	58
4031	230
4032	100
4033	145
4034	196
4035	120
4036	325
4037	100
4038	110
4039	320
4040	110
4041	85
4042	85
4043	100
4044	95
4045	145
4046	135
4047	99
4048	58
4049	60
4050	55
4051	95
4052	95
4053	95
4054	120
4055	134
4057	2570
4059	480
4060	115
4063	110
4066	65
4067	380
4068	22
4069	22
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4073	23
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4077	60
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4081	22
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4085	74
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4089	150

4093	90
4094	190
4096	105
4097	372
4098	110
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4502	120
4507	55
4510	135
4511	175
4512	98
4516	140
4518	130
4519	55
4520	130
4528	140
4532	135
4534	788
4539	110
4553	449
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LINEAR IC'S

702	75
709C 8 pin	35
709C 14 pin	30
709C TO5	35
710*	46
723* 14 pin	45
723* TO5	53
741 8 pin	22
741 14 pin	32
741 TO5	32
747C 14 pin	70
748C 8 pin	36
753 8 pin	150
78L82AWC*	51
AY-1-0212	580
AY-1-5050	141
AY-1-5051	125
AY-1-1313A	660
AY-1-6721/6	195
AY-3-8500*	510
AY-5-8550*	900
AY-5-1224A*	349
AY-5-1230*	490
AY-5-1315	560
AY-5-1317A	630
AY-5-3500*	810
AY-5-3507*	610
AY-5-4007	650
CA3011*	82
CA3014*	137

CA3018*	82
CA3020	170
CA3023	170
CA3028*	102
CA3028A*	102
CA3035	140
CA3036	180
CA3043	190
CA3045	140
CA3046	80
CA3048	220
CA3075	175
CA3080E*	80
CA3081	190
CA3089E	210
CA3090AQ	390
CA3123	200
CA3130*	94
CA3140	95
ICL8038CC*	345
ICM7205*	1150
LM300H	170
LM301AT	39
LM304	240
LM305H	
LM308T	140
LM309H	140
LM318H	205
LM318S	175
LM320-12*	150
LM379	398
LM380	98
LM381	170
LM382	125
LM3900	65
LM3909N	70
M252AA*	830
M253*	950
MC724*	175
MC663	
MC845	
MC1303	145
MC1304P	260
MC1310P	185
MC1312PQ	195
MC1458P*	90
MC1496L	101
MC1710CG	79
MEM780	
MFC6000	95
MFC6040*	97
MK50253*	550
MK50326*	550

MM2112 2N
NE350
NE518A
NE555*
NE556DB*
NE560*
NE561*
NE562B*
NE565A*
NE566*
NE567V*
RAM2102-2*
ROM2513*
SAS560
SAS570
SG3402*
SL403D
SL437A
SN72733
SN76003N
SN76013N
SN76023N
SN76033N
SN76115N
SN76227N
TAA550
TAA621AX1
TAA661A
TAA700
TAA960
TAD100
TAD110
TBA120S
TBA540
TBA540Q
TBA550Q
TBA641-A12
TBA641 BX1
TBA641 B11
TBA651
TBA800
TBA810S
TBA820
TBA920Q
TCA270Q
TCA270SQ
TDA2020
ZN414
ZN424E

WATFORD ELECTRONICS

(Continued from opposite side)

DIODES

AA119	15p
AAZ15	15p
AEY11	60p
A100	10p
A102	10p
Y100	24p
Y126	14p
Y127	14p
A9	9p
A47	8p
A70	8p
A79	12p
A81	15p
A85	12p
A90	6p
A91	6p
A95	8p
A200	9p
A202	8p
914	4p
916	5p
4001/2*	5p
4003*	6p
4004/5*	6p
4006/7*	7p
4148	4p
44	20p
/100V*	18p
/400V*	20p
/600V*	27p
/1000V*	30p
/600V	50p

R's*
yristors

50V	38p
100V	42p
200V	47p
400V	52p
600V	70p
50V	38p
100V	43p
200V	60p
400V	110p
600V	120p
400V	120p
400V	125p
400V	150p
106	150p
6D	55p
44	25p
45	45p
444	191p

***BRIDGE RECTIFIERS**
(plastic case)

1A50V	20p
1A100V	22p
1A200V	25p
1A400V	29p
1A600V	34p
2A50V	35p
2A100V	44p
2A200V	46p
2A400V	53p
2A/600V	65p
4A100V	72p
4A/200V	75p
4A400V	79p
4A/600V	97p
4A800V	120p
6A100V	73p
6A/200V	78p
6A400V	85p
BY164	56p
VM18	40p

ZENERS
Rng:3·3V–33V

400mW	9p
1·3W	17p

VARICAPS

MVAM2	135p
MVAM115	95p
BB104	40p
BB105B	40p
BB106	40p

Noise Diode

Z5J	105p

ALUM. BOXES with lid*

3x2x1"	45p
2¾x5¼x1½"	64p
4x4x1½"	64p
4x2¾x1½"	63p
4x5¼x1½"	70p
4x2¼x2"	64p
5x4x2"	86p
6x4x2"	91p
7x5x2½"	114p
8x6x3"	142p
10x7x3"	160p
10x4½x3"	142p
12x5x3"	160p
12x8x3"	205p

SPEAKERS
8Ω 0·3W

2"; 2½"	65p
2·5; 3"	58p
40Ω 2·5"	65p
64Ω 2·5"	65p
8Ω 5W 7" x 4"	190p
16Ω 5W 7 x 4"	205p

TRIACS*

3A400V	113p
6A400V	140p
8A400V	160p
10A500V	195p
15A400V	200p
15A500V	285p
30A400V	398p
40430	99p
40669	104p

DIAC*

ST2	25p

OPTO ELECTRONICS*
LEDS + Clip

TIL209 Red	13p
TIL211 Grn	23p
TIL212 Yellow	27p
0·2" Red	17p
0·2" Yellow, Grn, Amber	21p
OCP70	40p
ORP12	58p
2N5777	54p

OPTO ISOLATORS

TIL111/2	105p
TIL114	110p
TIL117	164p

7 Segment Displays

5-LT-01 Futabe	460p
TIL312·3" C.An	125p
TIL313 ·3" C.Cth	125p
TIL321 ·5" C.An	130p
TIL322 ·5" C.Cth	130p
DL704 ·3" C.Cth	99p
DL707 ·3" C.Anod	99p
DL747 ·6" An	180p
FND357	149p
XAN351 ·3" Green	175p
XAN625 ·6" Green	225p
MINITRON 3015F	240p

DRIVERS

75491/75492	85p

VOLTAGE REGULATORS*

723 DIL	45p
TBA625B	95p

TO3 Can Type

1A 5V	170p
1A 12V	180p
1A 15V	190p
1A 18V	210p
LM309K	150p
LM323K	625p
MVR5	180p
MVR12	180p
1A -5V	220p
1A -12V	220p

Plastic Case

78L82AWC ·1A 8V	51p
LM320-12	150p
MC7805 1A 5V	115p
MC7812 1A 12V	115p
MC7815 1A 15V	120p
MC7818 1A 18V	125p
FT8N24 1A 24V	130p

Variable Type

LM325N ± 15V	240p
LM326N ± 12V	240p
LM327N ± 5 —12	260p
LM317K 20W 1·5A + 1·2V to 37V	350p

SWITCHES*
TOGGLE 2A 250V

SPST	26p
DPST	31p
DPDT	35p
4 pole on off	58p

SUB-MIN TOGGLE

SP changeover	59p
SPST on off	54p
SPST biased	85p
DPDT 6 tags	78p
DPDT C/OFF	92p
DPDT Biased	115p

SLIDE 250V

1A DP	14p
1A DP C O	16p
½A DP	13p
4 pole 2-way	24p

PUSH BUTTON
Spring loaded

SPST on off	55p
SPDT C over	65p
DPDT 6 Tag	85p

FOOT SWITCH

Bulgin DPDT Unmounted	180p

LAMP HOLDERS AND LAMPS*

LES HOLDER Dome shaped, Red, Blue, Green, Yellow, White	16p
LES BULBS 6v and 12v	9p
MES HOLDERS Chrome cover, Red or Amber, Jewelled top	50p
LES OR MES Batten Holders	10p
MES BULBS 3·5V 6V 12V	9p
NEONS Mains, Sealed with Resistor, Sq. Top, Red or Grn. Round Top Red	24p
Neon with leads, 95V AC (No resistor)	9p

FERRIC CHLORIDE*
1lb bag Anhydrous **65p** + 30p p. & p.

DALO ETCH RESIST PEN* + spare tip **75p**

COPPER CLAD BOARDS*

Fibre Glass	Single-sided	Double-sided	SRBP 8" x 10·5"
6" x 6"	75p	90p	75p
6" x 12"	130p	175p	

CASES*

NJHC 1	85p
NJSF 2	275p

VERO

75 1239K	322p
1237J	215p
1238D	269p
1798K	399p

We stock many more cases, Vero, Classic, NJHC, NJSF ranges, our Vinyl-coated low cost attractive steel cases (PJ Range).

SWITCHES* PUSH BUTTON:
Miniature Non Locking

Push to Make **15p** Push to Break	25p
ROCKER (white): 10A 250V SP changeover centre off	28p
ROCKER: (black) on/off 10A 250V	23p
ROCKER: Illuminated (white) lights when on. 3A 240V	52p
ROTARY: (Adjustable Stop) 1 pole/2 to 12 way, 2p/2 to 6 way, 3 pole/2 to 4 way, 4 pole/2 to 3 way	41p
ROTARY: Mains 250V AC, 4 Amp	42p

KNOBS* fit ¼" shaft with grub screws, except K2 (push fit) & K8 (for sliders).

K1 Black or White pointer type	9p
K4 Black serrated. Metal top with line indicator 33mm diam.	22p
K4A As above but 25mm diam.	20p
K5 Black fluted metal top and skirt calibrated 0-10. 37mm diam.	26p
K6 PK2 as K5. pointer on skirt	26p
K7 Black, knurled, tapered. Metal top & skirt. Calib. 0-10, 30mm	25p
K8 Black or silvered for slider pot	10p
K10 Solid Aluminium, Amplifier Knob, Professional type with etch line indicator, tapered 18·5 × 17mm diam.	30p
K15 Black plastic ribbed body, white indicator line, 15mm diam. tapered coloured insert tops, Red, Blue, Yellow 19mm height.	16p
K16 As above but 23mm diam	20p

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	JACK PLUGS		SOCKETS	
	Screened chrome	Plastic body	Open metal	Moulded with break contacts
2·5mm	12p	8p	8p	
3·5mm	15p	10p	8p	
MONO	23p	15p	13p	20p
STEREO	31p	18p	15p	24p

Din	Plugs	Sockets	In line
2PIN Loudspeaker 3,4 & 15 pin Audio	13p	8p	20p
CO-AXIAL (TV)	14p	14p	14p

VEROBOARD* Pitch

	0·1 (copper clad)	0·15 (copper clad)	0·15 (plain)
2½ x 3¾"	36p	29p	19p
2½ x 5"	43p	39p	24p
3¾ x 3¾"	43p	40p	—
3¾ x 5"	48p	53p	34p
2½ x 17"	134p	107p	73p
3¾ x 17"	173p	143p	95p
4¾ x 17"	222p	—	145p
Pkt of 36 pins			28p
Spot face cutter			69p
Pin insertion tool			89p

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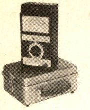

TYPE	U4312	U4313	U4315
Sensitivity D.C.	667 o.p.v.	20,000 o.p.v.	20,000 o.p.v.
Sensitivity A.C.	667 o.p.v.	2,000 o.p.v.	2,000 o.p.v.
D.C. Current	300 μA-6A	60μA-1·5A	50μA-2·5A
A.C. Current	1·5mA-6A	0·6mA-1·5A	0·5mA-2·5A
D.C. Volts	75mV-900V	75mV-600V	75mV-1000V
A.C. Volts	300mV-900V	15V-600V	1V-1000V
Resistance	0·02-3kΩ	1K-1M	300Ω-500kΩ
Capacity	—	0·5μF	0·5μF
Accuracy	1% D.C., 1·5% A.C.	1·5% D.C., 2·5% A.C.	2·5% D.C., 4% A.C.
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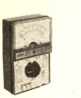
TYPES U4313 & U4313 PROVIDED WITH ANTI-PARALLAX MIRROR SCALES

TYPE U4324



Sensitivity:	20,000Ω/V D.C. 4,000Ω/V A.C.
D.C. Current:	0·06-0·6-60-600mA-3A
A.C. Current:	0·3-3-30-300mA-3A
D.C. Voltage:	0·6-1·2-3-12-30-60-120-600-1200V
A.C. Voltage:	3-6-15-60-150-300-600-900V
Resistance:	500Ω-5-50-500kΩ
Accuracy:	D.C. 2·5%; A.C. 4% (of F.S.D.)

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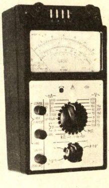

Sensitivity:
16700Ω/V D.C.,
3300/V A.C.

Ranges:
D.C. current: 0·06-0·6-6-60-600mA
A.C. current 0·3-3-30-300mA
D.C. Voltage: 0·3-1·5-6-30-60-150-300-900V
A.C. Voltage: 1·5-7·5-30-150-300-750V
Resistance: 2-20-200kΩ-2MΩ
Transistor collector cut-off current 60μA
Transistor D.C. current gain in two ranges 10-350
Accuracy: 2·5% D.C.
4·0% A.C.
5% D.C. current gain
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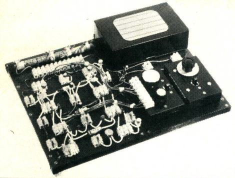

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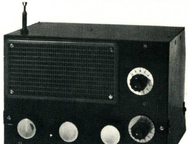

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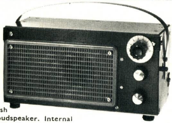

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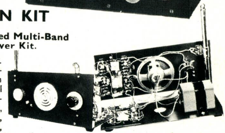

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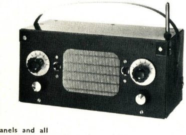

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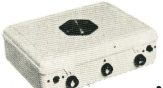

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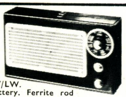
E.V.6.



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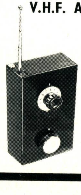

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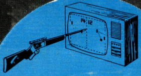

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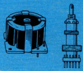

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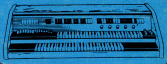

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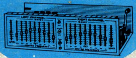

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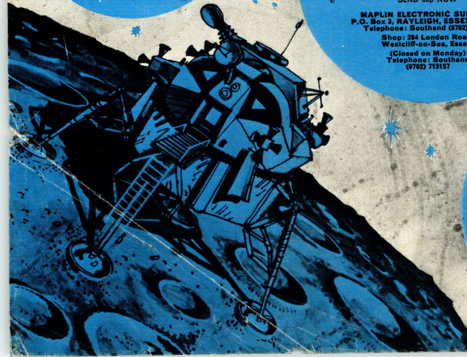

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